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Popular Articles on Electricity.

"Scribner's Magazine" for June marks the beginning of a new enterprise not less notable than the "Railway Series" commenced a year ago. It is the series of popular articles on "The Practical Applications of Electricity," a subject which they well say has become of chief importance in the scientific, commercial and industrial worlds. The opening article, by Professor C. F. Brackett, of Princeton, is entitled "Electricity in the Service of Man." It is an introductory paper which sets forth, in a clear and precise way, some of the common methods by which the more important electrical phenomena are produced, the laws which they reveal, and the principles involved in measuring electrical quantities such as the volt, ampere and ohm—terms which have lately come into general use, though not popularly understood. The principles so lucidly explained in this article will be fully applied in the rest of the series, which will describe modern telegraphy, electric lighting, household electrical devices, etc. The illustrations in Professor Brackett's paper show some of the best apparatus in a thoroughly equipped modern laboratory, and include a number of rare portraits and several figure-pieces.

Among the writers already secured for this series are announced Mr. C. L. Buckingham, of the Western Union, President Henry Morton, of Stevens Institute, Dr. M. Allen Star, a prominent authority on electricity in medicine, and A. E. Kennelly, chief electrician in Mr. Edison's laboratory. Each paper will be elaborately illustrated from special sketches and photographs, which it has been possible to make through the unusual privileges granted this magazine by the leading electrical companies.

Arc Lamp Regulated by the Expansion of the Conducting Wires.

The carbon-holders consist of two spiral springs of brass wire, to which are attached two stretched brass wires 0.45 mm. diameter, through which the current passes to the carbons; in so doing the wires are heated by the current. The carbons being at first in contact, as soon as the current is turned on, the stretched wires lengthen and pull the arc. As the carbons burn away, the resistance of the arc increases, less and less current passes, the stretched wires are not so much heated, they shorten, and the carbons are brought nearer together.

The magnificent twin screw steamer "Augusta Victoria" of the Hamburg-American Line, which recently broke the record from Southhampton to New York, is lighted throughout with electricity.

The Underground Question in Milwaukee.

The *Evening Wisconsin*, of Milwaukee, thus concludes an editorial, bearing on the question of forcing the wires underground: "With so much that may be expected from study of this all-pervading and tremendous energy, forbearance with the wrestlers with the knotty and important material problem of the age would seem to be dictated by common interest. It is not asked that the electric industry be permitted to progress without scrutiny—spurring, even though at times it seem a little unjust, may be a good thing in the end; but when it can be shown that popular demands are not consistent with the advance made by experts in the subjugation of electrical currents, the people should recede gracefully and give the electricians further opportunity. In this as in most instances of material advancement, the more haste the less speed."

— The Louisville Bagging Manufacturing Company of Louisville, Ky., has recently decided to introduce electric light into its factory, and have placed an order with the Brush Electric Company of Cleveland for an incandescent plant complete.

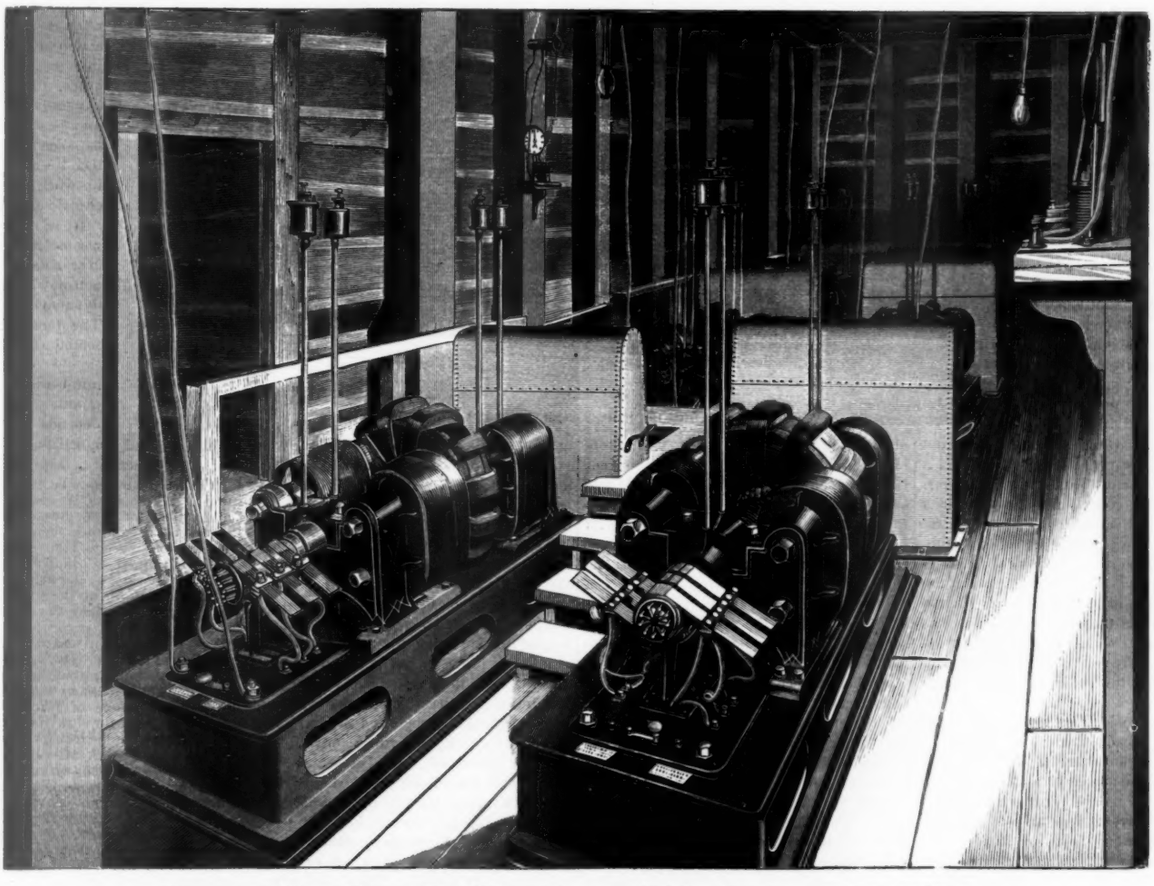
— Seneca Falls, N. Y., is increasing its electric street lighting.

Electrical Power Transmission at Virginia City, Nevada.

THE LARGEST INSTALLATION IN THE WORLD SUCCESSFULLY CARRIED OUT BY THE BRUSH ELECTRIC COMPANY.

"More power, economical power," has been now for several years the imperative demand of the owners of mining properties on the celebrated Comstock Lode, at Virginia City. The problem has been to work the enormous quantities of low grade ore at a profit. Large sums have been expended in carrying water from streams in the neighboring Sierra Nevada Mountains, for a distance of some 30 miles, to be utilized at the mines and mills on the Comstock. But this supply of water is limited and fickle, and by no means meets the demand. Operations have frequently been suspended on this account, causing great loss to the mine owners and hardship to the laborers dependent upon the active working of the ores.

The best engineering talent of the country has been called to work on this vital problem of power supply, and new arrangements have been made for increasing the amount of water, but vast powers now within reasonable range are still running to



UNDERGROUND POWER STATION (BRUSH MACHINES) AT THE 1,650 FOOT LEVEL OF THE CHOLLAR MINE.

waste, which the use of electricity alone can conserve.

At the stamp mill of the Nevada Mill and Mining Company, water power was obtained at the level of the mill from a reservoir on the side of the mountain. The mill contains 60 stamps with their complement of pans, settlers, agitators, rock breakers, etc. The water power readily available was entirely inadequate for the operation of the mill.

The problem was submitted to the Brush Electric Company through its agents, the California Electric Light Company, of San Francisco. A solution was speedily offered, and the plans were accepted by the owners of the Nevada mill and Chollar mine. The shaft of the latter is close to the stamp mill. It was proposed to collect the waste water from the surface wheel at the mill, convey it in pipes to the shaft of the Chollar mine, and thence down the shaft until a sufficient head should be obtained to produce the power required. The scheme was novel and presented many difficulties. However, experts pronounced the plans feasible and work was begun last winter.

At the 1,650-foot level of the Chollar mine a subterranean chamber was excavated out of solid porphyry for the reception of the dynamo electric generators and waterwheels. This chamber is 50 feet in length by 25 feet in width and 12 feet in height, clear of all timbers. From the tank containing the waste surface water two wrought iron pipes are led to the subterranean chamber, one 10 and one eight inches in diameter. At the bottom of the shaft a Y unites these two pipes into a single one 14 inches in diameter, out of which six six-inch pipes run to the nozzles of the waterwheels provided to drive the large Brush dynamo electric generators.

The underground electrical station is of the most interesting character, and is shown in our illustrations. The large Brush primary generators, of which there are six, are adapted to the conditions by a few mechanical changes from the standard pattern. They are mounted on a heavy cast iron base, and are provided with an extended shaft and outer bearing. On the armature shaft and between two bearings, the Pelton wheel is mounted and enclosed in a water tight cover. The cut of the generator is made from a photograph taken at the Brush Electric Company's Works, at Cleveland, before shipment, and shows a pulley on the armature shaft, arranged for testing runs at the factory. The water-wheel is attached to the armature shaft at the place occupied by this pulley, and a coupling is provided for detaching this entire end of the shaft carrying the wheel from the other end carrying the armature.

These Brush generators are each of 130 horse-power capacity and are compound wound for constant current. The electrical curve from these machines is almost ideally perfect and they require no regulator whatever. The current remains of constant strength under all conditions of load.

The head of water at the underground chamber is 1,680 feet. It has never before been attempted to run a water-wheel under such enormous pressure. This was indeed one of the most serious problems involved in the remarkable installation. From the various excellent forms of water-wheels the "Pelton" was selected as best adapted to work under the special circumstances. This wheel is the outgrowth of the old hurdy-gurdy form, and, as will be seen from the illustration, its buckets are provided with a very ingenious wedge-shaped partition, by which the stream of water is divided, and sweeps out through the curved sides in such a way as to produce a reactionary effect in addition to the impact. By the peculiar construction of the buckets all the water is also thrown down and out of the way of the wheel. The six Pelton wheels are each 40 inches in diameter, are made of phosphor bronze and weigh 220 pounds. They drive the generators at a rate of 900 revolutions per minute. The compact arrangement of combined dynamo generator and waterwheel makes it almost impossible for the visitor to the underground chamber to realize the enormous amount of power here at work. The machines are placed in parallel rows of three, and the swift revolving armatures are all that can be seen in motion as evidence of the 800 horse-power generated. The chamber is brilliantly lighted by 36 Swan incandescent lamps, operated in multiple series from one of the Brush generators, and there are several of the same lamps in the incline. Each generator circuit is provided with a dead beat ammeter of the Brush pattern, and a Brush voltmeter is also at hand, which is capable of measuring up to 3,000 volts. The generator circuits are led to a switchboard in the same dynamo-room, where any generator can be thrown on to any one of the outgoing motor circuits.

Leaving this subterranean power station and ascending the Chollar shaft are the circuits of copper wire, one to each generator. At one point these circuit wires pass through a shower bath of spray, but the insulation is so perfect that no leakage has yet developed. The wires issue from the mine shaft and are carried above ground to the electric motor room at the Nevada Mill. The total length of each circuit is a little more than a mile.

The electric motor room is shown in one of the large illustrations. The six motors are of the regular Brush constant current type, each of 80 horse-power capacity, and are arranged in a single row parallel with the main driven shaft to which they are all belted in the ordinary manner. The surface water wheel is also connected to this same shaft. It will be noted that there is here a very novel and interesting feature. This surface wheel uses the water in the first instance and furnishes part of the power to drive the main shaft. The waste water after this primary use, is carried down the Chollar shaft to the underground chamber where it drives the dynamos which generate the electric current and energize the electric motors above ground, which in turn furnish additional power to the main shaft.

Each electric motor has its own independent circuit fed from one of the generators. The well-known Brush centrifugal governor with which each motor is fitted, regulates the speed sensitively, and all or any number of the motors work perfectly in a battery together or with the water wheel. In the motor room there is also an ammeter for each electric motor to show at all times the current flowing in each circuit. The motors run at a speed of 850 revolutions per minute. Some difficulty was anticipated in operating the motors together on one shaft in the manner described, but none was encountered. The motors have not given a moment's trouble or annoyance of any kind from the start.

Some idea of the economic value of this electric power plant to the mine owners may be got from a statement of the saving effected by it. The surface wheel alone requires 312 miner's inches of water to develop power sufficient to drive 40 of the 60 stamps with which the mill is equipped. Moreover, this amount of water is seldom available. Two of the electric motors, working in addition to the surface wheel, will perform the same service with but 72 miner's inches of water, thus effecting a saving of about 77 per cent.

The net commercial efficiency of the plant, taking into account all elements of loss, including that in the conducting wires, is about 70 per cent. In other words, 70 per cent. of the power applied to the shafts of the generators in the underground chamber, is delivered for work at the main line shaft in the mill.

The waste water from the 1,650 foot level of the Chollar mine is piped into the Sutro Tunnel. It is now proposed to use this water a third time at a lower level for other work by means of a similar application of electrical machinery.

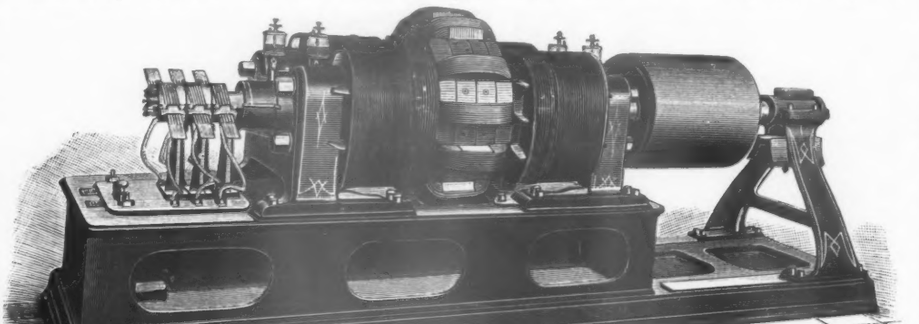
It was expected at the outset that many difficulties would be met in an installation of such novel and original character, which was also by far the largest ever attempted. The projectors, the Brush Electric Company and their agents, the California Electric Light Company, who assumed charge of the details of the erection, were very greatly pleased to find that their forethought had eliminated the troubles anticipated and predicted in almost all respects. Two purely technical difficulties were encountered when the plant was started experimentally, which caused some delay and anxiety. They were, first, the lack of any governing appliance for the water wheels, and second, the damage to the primary generators caused by the extreme heat and dampness in the underground station.

The Brush Electric Company in its original plans and specifications stipulated that the water wheel should be governed within reasonable limits, but this requirement was not met and the first generator and motor, started up experimentally, showed the necessity of this provision. The Brush Company was surprised to receive by the telegraph the first intimation that the makers of the water wheels had wholly neglected such an important matter, but was fortunately able to close the breach at once. A water wheel governor, invented and sketched out by Mr. W. B. Devereux, the prominent mining engineer, of Aspen, Colorado, had been placed in the hands of the company some time previously, and working drawings of it had been made at Cleveland. These were at once sent to California, the governors were quickly made, and this source of trouble was overcome. Mr. F. E. Smith, the electrical engineer in charge of the installation, made several modifications of the governor, after watching its performance, which proved of much value, and it has worked perfectly in practical service.

The second difficulty was met with equal promptness and likewise entirely overcome. The temperature of the subterranean power chamber is about 72 degrees F. The atmosphere is almost saturated with moisture—78 per cent. Any piece of metal taken into it begins immediately to "sweat." The generators when placed in this chamber were soon covered and saturated with moisture, and began to show leaks, while the motors above ground were absolutely free from any trouble.

The Brush Company was at once notified of this unanticipated source of difficulty, and Mr. Brush speedily devised a method of insulation which would certainly and completely resist the moisture of the sublimated atmosphere. Since its application the generators have worked admirably, and the entire plant is now at work regularly, performing its expected duty, and economizing the power available, as stated above.

The achievement of the Brush Electric Company, in connection with this plant on the Comstock, is a very notable one and of the greatest interest to mining engineers. The plant is the largest electrical power plant in the world. The company is making a specialty of powerful generators and motors for power transmission and distribution, and is taking large orders for them, not only in this country but also for foreign shipments. The latest contract announced is one with the Calumet and Hecla Mining Company for five of the large Brush generators of 130 horse-power, and five of the 80 horse-power Brush motors. A power station will in this case be built above ground for the generators, and the motors will be used for driving pumps underground. The plant goes to the copper mine at Calumet, Mich.



Brush Dynamo-Electric Generator, 130 Horse Power.

The Starting of the Dynamo-Electric Current.

A dynamo-electric current is a magneto-electric current which is reinforced by the mutual action of the current and the magnetic field. In order, therefore, that any dynamo-electric current may be started, there must be some residual magnetism to enable the machine to work as a magneto-electric machine.

It is, however, by no means true that any, however small, residual magnetism will give rise to a dynamo-electric current. The fact is, that it is essential that the speed should exceed a certain number of revolutions per minute; and this speed depends on the amount of the residual magnetism. There is thus for every machine a certain critical speed.

This statement may be verified by experiment. A machine is given the residual magnetism (r) by a current from some external source, and it is then driven at a speed n. If there is some kind of current meter in the circuit, it will indicate either the existence of a very weak current or the pointer will be driven far up the scale. In the former case n is less than the critical speed, in the latter greater; in the former it is only a magneto-electric current which is set up, in the second it is true dynamo-electric current.

The experiments made by the author on a Gramme and a Siemens machine go to confirm the exactness of Clausius' theoretical deduction, that for slow speeds the machine gives no (dynamo-electric) current; but it first begins to work after having reached a certain speed. The two cases are, however, not exactly similar, as Clausius considered that the machine first began to run at a very slow speed which gradually increased; while in the author's case the speed is always below the critical, so that no dynamo-electrical current will be produced however long the machine is kept running.

The question may be looked at from another point of view. In the first instance, the residual magnetism (r) produces a magneto-electric current $p\,r\,n$. This current produces a magnetic field $p\,r\,n\,.\,q$, which again gives rise to a current $p\,r\,n\,.\,q\,.\,p\,n$, and so on. The current can therefore be expressed by the infinite series:

$$i = p\,r\,n\,(1 + p\,q\,n + (p\,q\,n)^2 + (p\,q\,n)^3 + \ldots).$$

This series is convergent or divergent, accordingly as n is less or greater than $1/pq$—*i.e.*, accordingly as n is equal to or greater than a certain value which is constant for the same machine. In the above series, q is not a constant, but a quantity into which r enters as a factor, hence it follows that the critical speed decreases with an increase of the residual magnetism—a conclusion which is confirmed by the experiments.—*Annalen der Physik und Chemie.*

The National Committee on State and Municipal Legislation of the National Electric Light Association.

BY A. R. FOOTE, CHAIRMAN.

The resolution creating this committee was adopted so near the close of the Chicago Convention, that little opportunity was afforded in which to make up its membership or mark out its course of action.

The first problem has been how to secure a committee of able men identified with operating companies, each of whom would represent his State in whatever way might become desirable, in giving effect to the plans of the committee.

To secure the best results and to avoid misunderstandings, I printed a list of all names proposed and sent two copies to the officers and the executive committee of the Association, with the request that they would retain one copy for their information and return the other with their suggestions.

It became quickly apparent that some persons were not members of the Association whom it would be very desirable to have associated on the committee. In view of this, it was thought best to nominate such persons and invite them to become members of the Association at the time they were informed of their nomination as a member of the committee for their State. As soon as a majority of the lists were returned, a new list was prepared and sent to the same persons. When a majority of the second lists were returned, a third list was prepared for the information of the persons nominated. It is as follows:

[C. 6.]

LIST OF NOMINATIONS FOR MEMBERS OF THE COMMITTEE ON STATE AND MUNICIPAL LEGISLATION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

A. R. Foote, Cincinnati, O., Chairman.

1. Alabama—Wm. Gesner, Montgomery.
2. Arkansas—Dean Adams, Little Rock.
3. California—Geo. H. Roe, San Francisco, 227 Stephenson street.
4. Colorado—C. H. Smith, Denver.
5. Connecticut—J. C. English, Bridgeport.
6. Dakota—Judge Stone, Fargo.
7. Delaware—C. Newbold Trump, Wilmington, 50 West Third street.
8. Florida—G. Stuart Smith, St. Augustine.
9. Georgia—Judge H. E. W. Palmer, Atlanta.
10. Illinois—S. L. Nelson, Champaign.
11. Indiana—J. B. Carren, Indianapolis.
12. Iowa—Thomas Officer, Council Bluffs.
13. Kansas—M. Bebee, Hutchinson.
14. Kentucky—A. H. Barrett, Louisville.
15. Louisiana—M. J. Hart, New Orleans.
16. Maine—Geo. Westcott Portland.
17. Maryland—Arthur J. Stewart, Baltimore, 213 East German street.
18. Massachusetts—F. A. Gilbert, Boston, 17 State street.
19. Michigan—J. E. Lockwood, Detroit.
20. Minnesota—S. S. Leonard, Minneapolis.
21. Mississippi—H. P. Hawkins, Greenville.
22. Missouri—J. A. Corby, St. Joseph.
23. Nebraska—Rigan, Omaha.
24. Nevada.
25. New Hampshire — Alonzo Elliott, Manchester.
26. New Jersey—Wm. H. Moore, Plainfield.
27. New York—E. A. Maher, Albany.
28. North Carolina—D. A. Thompkins, Charlotte.
29. Ohio—A. R. Foote, Cincinnati.
30. Oregon—P. F. Morey, Portland.
31. Pennsylvania—A. J. De Camp, Philadelphia, 123 South 11th street.
32. Rhode Island—M. J. Perry, Providence.
33. South Carolina—Geo. B. Edwards, Charleston.
34. Tennessee—Robert L. Morris, Nashville.
35. Texas—David Hall, Galveston.
36. Vermont—J. M. Francisco, Rutland.
37. Virginia—Maurice B. Flynn, Richmond.
38. West Virginia — Jno. B. Garden, Wheeling.
39. Wisconsin—Henry C. Payne, Milwaukee.
40. Washington, D. C.—Geo. Truesdale.
41. Washington Territory — John H. Houghton, Tacoma.

Two copies of this list will be sent to each person nominated as a member of the committee—one to be retained by him and one to be returned with his acceptance. After receiving replies, I will send out a new list, showing those who have accepted, and what States are vacant.

When the full address of any person mentioned is known to you, please write it on the sheet you return.

Respectfully,
A. R. FOOTE, *Chairman.*

This history shows that the necessary thing now to be done is for all who are interested in the Association, especially those who nominated the persons named, to use the full strength of their influence to secure their acceptance of the appointment, and thus complete the organization of the committee. While desiring most earnestly to secure this end, the fact should not be lost sight of that it is better to have a vacancy than a name that represents only an address on which time and money must be expended without securing any yield of co-operative action.

In order that the nominees for the committee may be advised as to the course the committee will be expected to pursue, I prepared the following:

[C. 7.]

PLAN OF WORK OF THE NATIONAL COMMITTEE ON STATE AND MUNICIPAL LEGISLATION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

1. An examination will be made of the laws in each State to see in what particulars, if any, the electrical industry can be benefited by securing any practicable change in such laws.

2. All bills, affecting in any way the interests of the electrical industry, that were introduced at the last session of the Legislature of any State, but which did not become laws, will be examined to ascertain the *tendency of* legislation and to see if it is desirable that they should be passed.

3. Whenever any legislation is desired in any State, or if legislation is proposed that is not desired, copies of the bill proposed will be furnished to the chairman of the committee. He will then furnish the member of the committee for that State such data, arguments and citations as he may be able to provide, to enable said member to place information in the hands of proper persons through whom the desired result may be secured.

4. All work done in one State will be kept in printed form, so that it can be used at once in any other State. The work will thus become accumulative, and of such a thorough character as to be practically irresistible.

5. No legislative measure or economic principle will be advocated in any manner in the name of the committee without the approval of a majority of the whole number of its members, nor will the committee undertake to secure legislation in any State without the approval of the member for that State, and then only when sufficient preparation has been made to render success a reasonable certainty.

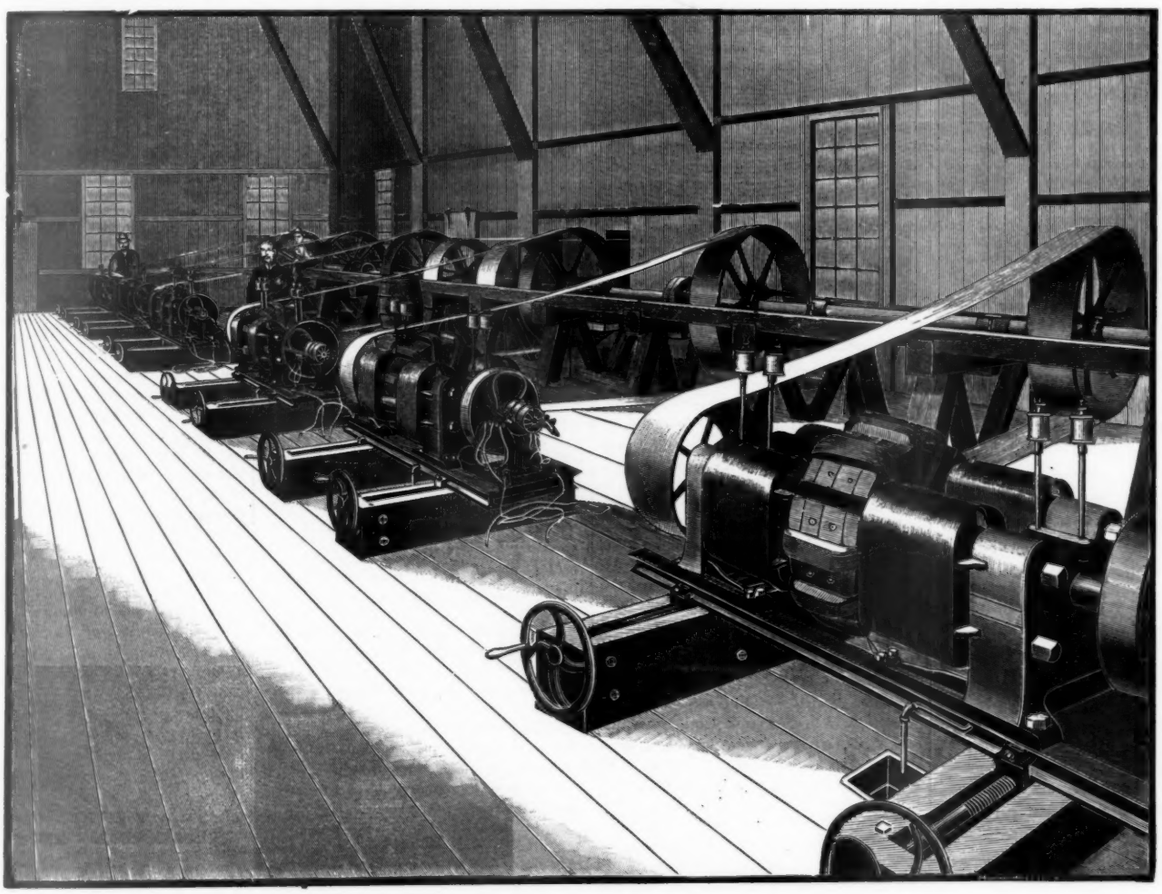
6. Each member of the committee will recommend to the chairman an attorney for his State, who will receive and preserve for reference, copies of all documents published or approved by the committee, to the end that if at any time it becomes necessary to employ counsel in that State, or if any special interest requires such service, said attorney will have the desired information and can represent the committee, or such special interest as may wish to employ him, and have at his command much of the data necessary to familiarize himself with the subject.

7. All other considerations being equal, an attorney residing at the capital of the State will be preferable.

8. The funds of the Association are not to be used for any of the expenses of this committee in any manner whatever.

Printed copies of the above were submitted to the officers and executive committee of the Association, and with them copies of the letters to be used in inviting the persons nominated to accept the appointment as a member of the committee.

In this manner the time since the adjournment of the Convention has been occupied in forming the committee and giving shape to an agreed basis for its work. No argument is required to prove that the results which this committee may achieve will be of great value to all who are interested in any way in the electric industry. It ought to be as readily understood that the principal limitation upon its influence and usefulness will be fixed by the manner in which those co-operate with and sustain it whose interest it is designed to serve. None who fail to co-operate with this committee should ever afterwards be surprised if their isolated efforts prove ineffectual to defeat or change undesirable, or to obtain desirable, State or municipal legislation.



BRUSH ELECTRIC ROOM AT THE NEVADA STAMP MILL.

Plattsmouth, Neb.— A company to build and operate a factory for incandescent electric lamps, with a capital of $50,000, was organized at Plattsmouth. Of the stock, $10,000 was subscribed in the city and $40,000 by outside parties. The factory is the only one of its kind west of Cleveland.

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GEO. WORTHINGTON, - Editor.
CHARLES W. PRICE, - Associate Editor.
T. J. McTIGHE, Electrician and Manager Patent Bureau.

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Timothy W. Sprague, 192 Summer Street, is our representative at Boston, Mass.
Mr. C. C. Haskins, City Hall, Chicago, Ill., represents the REVIEW in the West.
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☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, MAY 25, 1889.

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The next meeting of the National Telephone Exchange Association will be held at the West Hotel, Minneapolis, Minn., commencing Tuesday, September 10th, at 11 A. M. The hotel is on the American plan, and the rates to delegates will be $3.00 and $3.50 per day, the latter price including room with bath. This is a substantial reduction from the regular prices of the house, which is one of the finest in the country. Within a few days, the secretary will mail to all probable attendants from the Eastern States, a circular giving details of the special vestibule train which it is proposed to run through from New York to Minneapolis without change, provided a certain number of passengers can be secured. Delegates from this vicinity, from New England and all parts of the East, are requested to unite in making this proposed party one of the most pleasant in the annals of the Association.

Members of the Electric Club are reminded that Mr. Erastus Wiman is to deliver a lecture entitled "Electrical Possibilities as Viewed by a Business Man," at the Club rooms, on Thursday evening, May 28.

The adverse legislation reported from various State capitals upon measures intended to fix telephone charges is a sign of a more conservative spirit than that which marked some previous efforts in the same direction. The legislators of to day are evidently profiting by the example afforded in the recent repeal of some such measures adopted some time ago.

Over two hundred delegates from all parts of Kansas gathered in Topeka last week to attend the annual convention of the Kansas Republican League. Nearly every delegate availed himself of an invitation to go over the new electric road just put in there. A special trip was arranged, and five motor cars with three tow cars ran on the time of one of the regular trips. The power station stood the test nobly, not the slightest effect of the strain being shown. The trip was successfully accomplished, and Kansas leaguers are now firm advocates of electric street railways. Let the good work go on.

Electric light people in England have some things to be thankful for, even if American manufacturers have picked some pretty large plums. Our valued contemporary, the *Electrician*, commenting upon the edict relating to the fate of overhead wires in England, says: "We have reason to think that the conditions will be found to be of a character and not such as will in any way interfere with the legitimate development of the industries concerned." If they had a mayor who was fond of trying his little hatchet on electric light poles, possibly they would not feel so easy about the as yet unpromulgated edict.

The present exhibit of a comparatively new telpherage system at the Old South Church, Boston, brings to mind what a number of new inventions and appliances in their early stages of development those old historic walls have harbored. The electric novelties alone have drawn thousands to this famous old meeting-house now made an exhibition hall. 'Twas there, if we are not mistaken, that the phonograph was first shown in New England and the wonders of the microphone brought to Boston's cultured ears. Electric power came in for its share of attention, and but a short time ago, too, the exterior of the building was completely outlined with incandescent lamps from the top of the steeple down, making a most striking and novel sight. Truly the Old South and electricity may be said to be mutually indebted.

AN ELABORATE TESTING STATION.

The appropriation from the earnings of the Paris Exposition of 1881 which was set apart for an electrical standardizing laboratory has borne fruit in a full-fledged testing station in a specially constructed building in the Place St. Charles, Grenelle, Paris. The laboratory was constructed and is now under the charge of M. de Merville, acting with a committee of 10 other members of the *Société Internationale des Electriciens.*

The usefulness of this institution from an immediate and industrial standpoint cannot be questioned, while on a purely scientific ground it cannot but result in profitable researches into realms as yet but little explored. The building contains not only rooms devoted to the standardizing of commercial ammeters, voltmeters, electro-dynamometers and like instruments, but also a large laboratory devoted to general research. Although we boast in this country several admirable electrical laboratories, yet most of them belong to private persons or corporations doing a commercial business. The need in this country of such a laboratory as that just opened in Paris, cannot but eventually result in a similar institution in some one of our centers of learning.

RAPID INTRODUCTION OF THE ELECTRIC MOTOR.

Very quietly and with astonishing rapidity has the electric motor made its way into the hearts of power users. It is really astonishing, even to the electrical enthusiast, how great has been the headway made by this modern servant of man. It has displaced steam engines in many instances in almost every branch of industrial manufacture; it even has been substituted for water power to the extent of using the latter for electrical generator, the leads for distribution and the indefatigable motor for local service, since greater economy is generally obtainable in this manner. It is fast relieving the horse in traction work, and bids fair even to do the uncomplaining mule out of his job. In all parts of the country the electric motor's busy hum can be heard. It is probably safe to say that there is not a town large enough to support a lighting plant that has not also advanced enough to adopt the motor to a greater or less extent. And we predict that the time is not very far distant when the electric motor, as the immediate source of applied power, will be a greater factor in the field of usefulness than the steam engine, and the latter will be relegated to the driving of electric generators.

In certain lines of work, however, the electric motor has a long way to go in the way of improvement before it can be used, if ever. For instance in rolling mills and other establishments of a kindred nature, where the required power cannot be subdivided, and enormous strains are put upon the driving engines, as at present constructed, the electric motor has no place, and we doubt if it ever will have. But in all cases where the useful effect is wanted at many points and in moderate amount, the electric motor will have the best of the contest. Already it has made great strides in the propulsion of street cars, and there are for this purpose alone a great number of motors in daily operation. The usefulness of the electric motor and its almost universal adaptability is strikingly shown by the enormous plant we illustrate elsewhere in this issue. Certainly this new servant of man is proving to be a rich prize.

THE WORK OF THE NATIONAL COMMITTEE BEGUN.

The National Committee on State and Municipal Legislation, of the National Electric Light Association, of which Mr. A. R. Foote is chairman, is fast taking a shape where it will be felt in the community.

The difficulties of getting this committee into shape were by no means inconsiderable, for several reasons. Made up as it is, of one member from each State in the Union, it has been necessary to carry on all the work by correspondence, which is of course a slow and laborious process. What has been still more embarrassing is the fact that there are several States in which the Association has no member, and the chairman has found himself, in several cases, obliged to solicit representative men in kindred electrical pursuits to join the Association, that they might serve on the committee, which even now has not a full complement of members.

The plan of operation sketched out by the chairman, at the February Convention in Chicago, and still further elaborated in a recent communication (Form C. 7), leads one to believe that if carried out in detail the work of this committee will be of much practical use.

An examination of the laws of each State and a determination if the electrical industries can be in any way benefited by their change; a study of all legislative bills to see if it is wise for the electrical fraternity to aid in their passage; a bureau which shall be the repository, and from which may be obtained all data, arguments, citations, etc., touching legislation on electrical industries, is an undertaking not to be entered into lightly nor to be carried into successful operation by anyone not skilled in the collection of facts and the sifting of truth from error.

History of the Transformer.

The introduction of the alternating current and transformers to so great an extent in the last year or two has made anything pertaining to the history and construction of the transformer of interest. The publication of an English translation of Prof. F. Uppenborn's "History of the Transformer" is therefore pertinent at this time, and the little book cannot fail to be of interest. The author, as is known, is the editor of *Centralblatt fur Electrotechnik*, and chief of the electro-technical testing station at Munich. In his book he goes back to the very beginning of the discoveries which led up to the invention of the transformer, and takes Faraday for the starting point of his observations. From his time down to the present the course of the transformer is traced, and plain and concise statements made with the hope that the reader may form a correct judgment of the services rendered by the several inventors. The book is illustrated with cuts and diagrams, and marginal references are made which facilitate the study of the subject in regard to dates. ["History of the Transformer," F. Uppenborn, London and New York, 1889. E. & F. N. Spon.]

Whipple's "Electric Railways."

Advance proof sheets of Mr. Fred. H. Whipple's new book on Electric Railways, show that in it the author has gone into the subject with the same thoroughness and detail that characterized his earlier work on Municipal Lighting. A chapter devoted to the cost of producing, transmitting and applying electricity for street railway purposes presents some very interesting reading on these important and timely subjects, and while the author ventures the statement that a whole book might well be given to these same topics, he seems to have covered their salient features in a straightforward and concise style. The propositions and deductions are supplemented with tables of figures and estimates, and comparisons of various electrical systems with each other are made and also with horse and cable systems. It is safe to say this chapter is but an example in general arrangement and purpose of the entire book, and it cannot fail to fill a want, when it appears as it is expected to, this week.

A New Book of Electrical Rules, Tables and Formulæ.

A new compilation of Electrical Rules, Tables, Tests and Formulæ, by Andrew Jamieson, C. E., F. R. S. E., has just been published in convenient form. In it are included formulæ of absolute units, practical, electrical, mechanical, heat and light units; tables of electro-chemical equivalents; laws of electrolysis; chapters with tables, etc., on practical electrical measurements; on electrical conductors, insulators, batteries, submarine cables, aerial land lines, etc., all arranged in as compact and concise form as is consistent with clearness and completeness. Tables and formulæ for electric lighting and transmission of power form the last chapter of the book. ["Electrical Rules, Tables and Formulæ," by Andrew Jamieson. New York, The Industrial Publication Company, 1889.]

The Universal Electrical Directory.

J. A. Berly's Universal Electrical Directory for 1889, published by the well-known firm of William Dawson & Sons, Upper Thames street, London, keeps up the reputation established by its predecessors as a complete and reliable handbook for electricians everywhere. In addition to its lists and other matter belonging strictly to a directory it contains much other interesting and valuable information, and its advertising pages contain the representative firms of the world. This publication is the pioneer in its line in the world we believe, and succeeds in holding its own against all new comers. The high esteem in which it is held as an advertising medium is shown in the renewal of some contracts for eight years. ["The Universal Electrical Directory," J. A. Berly, published by William Dawson & Sons, London, 1889.]

LATEST ELECTRICAL NEWS.

At Boston, Chicago and Other Points.

OUR BOSTON LETTER

A New Incorporated Company.—The Holtzer Cabot Electric Company has been organized and incorporated, with a capital of $55,000 under the laws of the State of Massachusetts (which by the way require the full amount of capital paid in), and will continue the business carried on by Messrs. Holtzer & Cabot, of this city. The officers of the company are: Charles W. Holtzer, president; George C. Cabot, treasurer; I A. Foster, secretary. Besides the sale and equipment of annunciators, bells, electric gas lighting outfits, etc., the company are engaged in general electric light construction work.

A Projected Storage Battery Line.—The Lynn and Boston Horse Railroad Company are considering an offer from one of the leading storage battery companies to furnish a storage battery car capable of drawing a second car to run to Chelsea beach in Revere from Chelsea square, or from Scollay's square, Boston, if permission from the West End road be obtained. Mr. J. G. Low, of the Low Pile works in Chelsea, has offered to furnish the current from the factory electric light plant for charging the cells.

The Defeat of the Elevated.—The elevated railroad bill is defeated and the prophets are once again mistaken, an almost unanimous passage in the House carried by the war-cry of "Down with the West End railroad," was supposed to insure the passage of the bill in the Senate. But the fates decided otherwise if not wisely. In reality the measure is not defeated, but merely postponed until the overhead electric system has an opportunity of being thoroughly tried on the surface roads, it being strongly claimed that rapid transit in reality and not merely in name, as is the case with the New York elevated roads, can be easily secured by the electric motor.

The Telephones and the Overhead Wires.—The telephone interests are thoroughly aroused over the prospect of a wholesale interference with their circuits by the overhead system of street railways. The service in parts of Cambridge or on lines that pass through Cambridge is said to be very poor. In the case of lines, however, in Lynn no trouble from the electric road is experienced, and hopes are expressed that when heavier rails are laid and a larger return wire used all disagreeable noises will be prevented. The most sweeping guarantees were given Mayor Hart by the West End Railroad Company before he signed the permit to use the overhead system. They promised practically to reconstruct the entire telephone and fire alarm system of the city on metallic circuits in case the overhead system causes any interference with the operations of the present lines.

A Large Fuel Saving.—Compound condensing engines are likely to have at least a fair trial. The second Macintosh & Seymour 200 h. p. engine is now being set up at the Cambridge Electric Light Works. Cards from the first engine of this type operating street railway generators indicate a fuel saving of over 40 per cent.

The Exodus for Europe.—Predictions for electrical New England for smmmer of 1889. Almost total absence of electricians. Exodus for Europe. If one-half of those who are booked for the Paris Exposition complete their journey, the spectator portion will be represented in a style worthy of the importance of American exhibitors.

Municipal Lighting.—The talk about municipal lighting has about died out. The question was only raised by those who can only obtain a hearing by attacking some noted person or industry. F. M. G.

Boston, May 20th, 1889.

The telephone rate bill has been defeated in the Missouri Senate, 17 against to 11 for the measure.

The bill to regulate telephone rental charges has been laid on the table by the Michigan Senate after an adverse committee report.

From the Helena (Mont.) *Journal:* "The phonograph has reached Helena, and an agency for the rental of the instruments (they are not to be sold) will be established in a few days. This will possess Montana's capital of all the appliances of civilization, the phonograph having completed the list. We now have the telephone, electric light, water works, phonograph, Salvation army, an idle roller skating rink, a defunct toboggan slide, a street car and a motor line to which we 'point with pride.'"

OUR CHICAGO LETTER.

Thunderstorm.—A heavy rain with unlimited thunder and lightning enlivened the early hours of the morning on Thursday, and by way of variety, lightning hit the Germania Mannerchor Club House at two o'clock, slivering the flag staff, and ripping up the slate and tin work of the roof. It tore off and scattered the ceiling and wall of an upper room.

One More.—The Colby Electrical Manufacturing Company of this city has just been incorporated with a capital stock of $100,000, by E. J. Colby, H. J. Hays, and F. W. Parker, to manufacture electrical and other goods. The last named gentleman is a member of the Chicago Club, and is intimately connected with several recent electrical enterprises.

State Electricity.—The Illinois State Electric Medical Society held a two days' session at Springfield, Tuesday and Wednesday of this week. Finley Ellingwood, of Chicago, was elected president.

County Electricity.—The county electrician here has become so crowded with work that an assistant has been given him at a salary of $1,000 per annum.

City Electricity.—Prof. Barrett presented his plan for lighting Chicago with electricity to the council committee on gas, oil and electricity this week. All his plans are so arranged as to anticipate the future, when more money can be obtained for the purpose. Eleven districts are provided, each of which will contain its own central station, from whence the lines will radiate.

Plants 1, 4 and 6 are already located. Number one is at the Exposition Building, on Michigan avenue, where we met so many of our Eastern friends in February. Number four on Chicago avenue. Number six is at the Jefferson street engine house, near Van Buren.

The Professor's proposition apportioned sums for the various stations as follows:

District 1	$60,000
" 4	60,000
" 6	55,000
" 8	55,000
Total	$230,000

The committee adopted the Professor's plans, and the work will be commenced as soon as the council endorses the committee's recommendation. The work will be prosecuted with vigor, once commenced; and while great good fortune permitted the work to be carried on up to the very eve of the holidays last year, no such chances will be taken with the work of 1889. The Christmas present business did well enough for once, the Professor says, but once is plenty; the city will get its electrical present earlier this year, if he can only get a good start.

The Club.—A special meeting, by order of the president, was held on Wednesday evening, and a regular love feast was the result. The rooms are beautiful now, and there is more to come. The Club has money in the treasury and everyone is as happy as a young hen with her first brood. A ladies' parlor and toilet room are among the nice and beautiful ideas, and a piano with a stack of music is another. On the upper floor are the billiard and dining rooms, and an entrance from the Club's rooms into the finest restaurant in the city—Kinsley's—gives such of the boys as will, the finest bill of fare in the rowdy West, and to see the boys gather round when lunch hour arrives, is indicative of great goodwill and enjoyment. Seventeen new members have been made during the last ten days, and there are several who have knocked for admission since the 15th.

More Underground.—C. H. Haskins, he of the Wisconsin Telephone Company, is once more in Milwaukee after an absence of a couple of years more or less. He is there to superintend the placing of the telephone wires underground. The wires will be placed in wooden conduits specially constructed for the purpose, and run through the alleys with a pole for each block for distribution.

A Lot of Good Fellows.—E. H. Jackson, of the Standard Underground, Pittsburgh; H. F. Lufkin, of the C. & C. motor; Adjt. P. C. Ackerman, of Providence, and F. B. Pond, of the Pond Engineering Company, all report favorably on the Club rooms, which they have inspected within the last few days. Fred. Degenhardt, who is guilty of telling German stories of that class which leave no unpleasant taste in the mouth, with excellent imitations, has just closed out a sale of two and a half tons of wire for a plant at Traverse City, Michigan, and a nice wire order for the telephone exchange at Springfield, Ill. Mr. W. H. Wissing has just opened a western agency for the Wings disc fans, at Lake and Dearborn streets. Mr. George Cutter has secured the contract for furnishing the wire for the large arc light installation at St. Louis, by the Sutter Company. The contract calls for 800 miles of Simplex to begin with, and George thinks he will double the amount by January next. Chas. J. Van Depoele gladdened the hearts of his friends by calling upon them. C. C. H.

Chicago, May 18, 1889.

SOUTHERN ELECTRICAL NOTES.

New Plant for Decatur.—The Thomson-Houston Electric Company, of Decatur, Ala., have bought out the electric light companies of Decatur and New Decatur, and will put in a new plant to cost $25,000. Capacity will be 60 arc lights. A building 50x140 feet will be erected.

New Edison Plant.—The city of Bainbridge, Ga., has let contract for the erection of the electric light plant to the Edison Electric Company.

A New Company at Chattanooga.—W. H. Dorsey, W. F. Paine, J. H. McLean and others have applied at Chattanooga for a charter to manufacture electricity to conduct a general messenger, telephone, fire-alarm and patrol-call business.

Short Electric Lighting Items.—At Pocahontas, Va., the Norfolk and Western Railroad Co. are erecting an electric light plant. The city of Richmond, Va., is investigating the cost of an electric light plant, with the view to purchasing one. The Electric Light and Power Co. of Harrodsburg, Ky., are ready for bids for machinery for their plant.

Electricity and Manufacturing.—A company is now being formed at Wytheville, Va., with capital, minimum, $40,000, maximum, $250,000, called the Electric Power and Improvement Co., for the purpose of lighting and furnishing power for the town of Wytheville, Va., manufacturing fertilizers, running wood-working machinery, manufacturing wool and cotton, milling, etc. Operations will soon commence.

Pushing Their Work.—Mr. Charles F. Prendergast, secretary of the Savannah (Ga.) Electrical Company, recently incorporated, has just returned from New York, where he went to complete the arrangements for the electrical apparatus and appliances to be used in the conduit of the company's office. The stock has not only been subscribed, but paid in, and active work will soon be inaugurated. A central site is to be located. Estimates are on file for the neccessary poles for the company's wires. Rights of way have been granted by council.

A Singular Accident.—Mr. A. Hudd, telegraph operator at Jasper, Ala., was so shocked by an electrical current while sitting at his instrument last week, that he died from the effects on Sunday. He was sending a message, when he was suddenly hurled from his chair in an unconscious condition. Several friends who were standing near, attended him, and in half an hour he regained consciousness. He sent another message, closed the office and walked a half mile to his hotel. He complained of feeling badly, and a friend remained in the room watching over him till he seemed quite restored and was asleep. An hour later, his friend returned and found him dead in bed. Mr. Hudd had been at Jasper only a short time and was very popular. He came to Alabama from Ohio, was married and had several children.

Branching Out in the South.—The Manhattan Electric Light Company, of New York, have secured franchise to erect an electric light plant at Athens, Tenn.

Light for the Students.—The University of Tennessee, Knoxville, Tenn., will spend $30,000 in improvements, adding first an incandescent electric light plant, with capacity for 150 lights.

Electric Power Will Be Used.—The Staunton, Va., Improvement Company will build a street railroad three miles long, to be operated by electricity, and are now investigating various system.

An Alabama Plant.—The Merchants' Electric Light Plant, at Birmingham, Ala., is fast getting into shape. The company has built in the most substantial manner. The power will be supplied by the largest boiler of its type in the State. It is of the locomotive type, six feet in diameter, 18 feet long, and has a generative capacity of 150 horse-power. One of the features of the plant is an improved switchboard, by which any or all of the surplus dynamo power can be placed on the most used circuit. The company has its lines up, and is placing lamps as rapidly as possible.

EDWARD A. OLDHAM.

Charleston, S. C., May 13, 1889.

The London *Star* has adopted electric light as a novelty on its 34 paper distributing carts. A small storage battery is placed in the boot of the gig, and communicates with an incandescent lamp fixed at the top of a rod, which rises considerably above the highest point of the vehicle.

A novel feature of the plant being installed at the Chestnut Hill Pumping Station, in Boston, by the Standard Electric Company, of Vermont, is the absence of all belting. The engine and dynamo are connected by a friction pulley, the arrangement allowing compactness unattainable by other methods.

PERSONAL.

Mr. Henry D. Sears, formerly with the Bell Telephone Company in Boston, is now purchasing agent for the Thomson Electric Welding Co., with headquarters at the Kilby street office of the company in Boston.

George W. Hunt, agent of the Mutual Electric Manufacturing Company of Brooklyn, was in West Troy recently making arrangements for the establisment of an electric plant by which to light the village streets.

Mr. C. J. H. Woodbury will join the fast increasing colony of prominent electrical people on the other side within a few days. Mr. Woodbury will sail on Saturday, May 25, with the Societies of Engineers, on the "City of Richmond."

William B. Gill, superintendent of the sixth district Western Union Telegraph Company, with headquarters at Philadelphia, has been appointed by Gov. Beaver, one of the Pennsylvania commissioners to the Paris Exposition.

Mr. J. E. Crandall, electrician of the Chesapeake and Potomac Telephone Company, of Baltimore, has been making a tour of inspection through the principal telephone exchanges in this section, preparatory to placing an order for a new switchboard for the Baltimore station.

A party consisting of Mr. W. J. Jenks and brother, Mr. P. H. Alexander, Mr. L. Steiringer, Mr. Wm. D. McQuesten and Mr. Fuller started Friday for the woods of North Carolina, where two weeks or more will be spent in a search for ozone and other attributes of that delightful clime.

Mr. George W. Fishback has established the Microphone Carbon Battery Co. at 112 Liberty street, New York, for the manufacture and sale of the microphone cells. The company has acquired control of all the rights and privileges for manufacturing this battery which is heartily endorsed by its users as most efficient for open circuit work.

Mr. H. L. Storke, president of the Empire State Telephone Company, and vice-president of the Central New York and Hudson River Telephone Companies, has been for two weeks, and still is, very ill at his home in Auburn, N. Y. In common with a host of other friends, the REVIEW hopes to able to record his convalescence in the near future.

The Westerly, R. I., Gas Light Company has purchased the Westerly Electric Light Company's plant.

At a meeting of the directors of the New England Post-Electric Company, Friday, Gen. John M. Corse, postmaster of Boston, was chosen president and has accepted the position.

The following is an abstract from a letter sent out to the stockholders of the Edison Electric Light Company by Mr. J. B. Williams, president of the new Edison General Electric Company:

A corporation called the Edison General Electric Company has been formed, to acquire the stocks of the Edison Electric Light Company and the three Edison Manufacturing Campanies—to wit: the Edison Machine Works, Edison Lamp Company, and Bergmann & Company—and for the other purposes set forth in its articles of incorporation. Arrangements has also being made to acquire stock in the Sprague Electric Railway and Motor Company, should it be found desirable to do so.

The said General Company is organized under the laws of the State of New York, with a capital of $12,000,000. Agreements have been signed for the purchase by this new company of the capital stock of the said three manufacturing companies, payable partly in cash and partly in the stock of the new company.

The new offices of the General Company are in the superb new building corner of Wall and William streets in this city.

Telephonic News

*** Cables are being laid for a telephone line between Charleston, S. C., and Sullivan's Island.

*** The Oswego Telephone Company's central office has been moved to new quarters on Second street.

*** At the Monday evening meeting of the Boston board of aldermen permission was granted the Edison Electric Illuminating Company and the N. E. Telephone and Telegraph Company, to erect about 50 more poles in the streets of Boston.

*** The Massachusetts legislative committee on mercantile affairs have voted to report a bill authorizing the American Bell Telephone Company to increase its stock by $10,000,000. A proposed clause requiring that the new stock be sold at auction will not be incorporated in the bill.

*** Owing to the multiplicity of lanes and alleyways in Philadelphia, the arrangement by which the Bell Telephone and Western Union Telegraph Companies are proceeding to get rid of overhead wires on the main streets furnishes one easy and rational settlement of the overhead wire problem.

*** A committee of the city council of Milwaukee, Wis., is grappling with the subject of certain rights and privileges in regard to electric conduits. The telephone company was granted permission to lay conduits in 1883, and put down a conduit from the old jail to the court house. Nothing more was done, and it is now very unjustly claimed that by this inaction the right to further extend the conduit system is lost.

*** One hundred and fifty men have been at work on the Long Distance Telephone line between Providence and New York since the 1st of April. The wires are fast being struck, 20 already being in place to Greene's station. The wire is No. 12, copper, hard drawn. Connection between the Long Distance office and the beginning of the pole line is made by a Kerite aerial cable, comprising 50 wires, and a smaller cable will be swung later.

*** The Central Pennsylvania Telephone and Supply Company are erecting an exchange at Bridgeway, Pa. The radius will include Wilcox, Johnsonburg, Daguschando, St. Mary's, Dagus and Toby Mines. Some 75 subscribers were secured before the work was commenced. When the exchange is in operation the number of subscribers will doubtless reach 90 to 100 business interests. The plant will be well and substantially constructed and the most improved equipment installed.

*** If negotiations which are now in progress are consummated the Republicans of Wisconsin will lose their campaign manager. Henry C. Payne, chairman of the Republican State Central Committee, will in all probability become a resident of Chicago and retire from politics. The position offered is that of president of the Western Consolidated Companies of the Bell Telephone Company with headquarters in Chicago. The enterprise as outlined would mark a departure in telephoning, and will consist of a long distance system connecting Chicago, St. Louis, Cincinnati, Indianapolis, Omaha, Kansas City, St. Paul, Minneapolis and Milwaukee. The center of this system will be Chicago, and it is thought that eventually New York, Philadelphia, Boston and Washington will be connected with all the other points. The Bell companies embraced in this great consolidation will be those of Illinois, Iowa, Michigan, Indiana, Minnesota, Ohio and Missouri.

*** The directors of the Albany railway company have decided to ask the common council for permission to erect poles and string wires on State street and Washington avenue.

*** If all the telephone wires in this country were stretched in a continuous line they would reach seven times around the earth, and if the messages transmitted every day were sent through one set of instruments, allowing two minutes for each message, it would require nearly ten years to transmit them all.

*** The annual statement of the Providence Telephone Company shows that the net earnings for the year were $4,000 in excess of those of the previous year, notwithstanding the considerably increased expenses, total net earnings being nearly 18 per cent. of the capital stock, $400,000. The construction account, etc., shows a surplus of $37,000.

*** Captain Willard L. Candee, of aerial telegraph and telephone wire fame, treasurer of the Okonite Company, New York, sailed last Saturday for Havre. Like many others aboard, his objective point is Paris, where he will represent the Okonite Company at the Exposition. Numerous friends and a number of the members of Brooklyn's crack regiment (23d), in which Mr. Candee holds a captaincy, and a delegation from the Electric Club, were on hand to bid him *bon voyage*.

Burying the Wires in Philadelphia.

The Philadelphia council's sub-committee on law last week gave further consideration to the resolution requiring the removal of telegraph, telephone and electric light poles, and the placing of the wires underground by October next.

Dr. S. M. Plush, of the Bell Telephone Company, said that his company had wires underground on Market street, from Fourth to Thirteenth, and on several streets east of Fourth, between South and Vine. He explained that when the work is completed no main street will be crossed, and poles will be used only where it is necessary to connect with customers.

Superintendent Gill, of the Western Union Telegraph Company, informed the committee that that corporation would use the Bell Telephone Company's conduits, but the messenger service will have to be operated by some system of wires stretched across the housetops. In answer to a question he said that it would take about a year for the company to place its heavy wires underground. Chairman Anderson suggested that it would be a good idea to have the pledge in writing, and Mr. Gill promised to prepare a plan.

Professor Marks, of the Edison Company, said that their underground system was in perfect order, and James Brooks enlightened the committee on his system of conduits. He said that there were at least three empty conduits on Chestnut street, and there was no necessity for overhead wires. The expense of burying the wires would be a mere bagatelle. The same committee met again Tuesday. Assistant Gen. Manager O'Brien, of the Reading Railroad Company, said that while he considered it beyond the bounds of practicability to bury the wires within the time specified, still his company will promptly respond if any feasible project is adopted and the city will extend all facilities to aid the company.

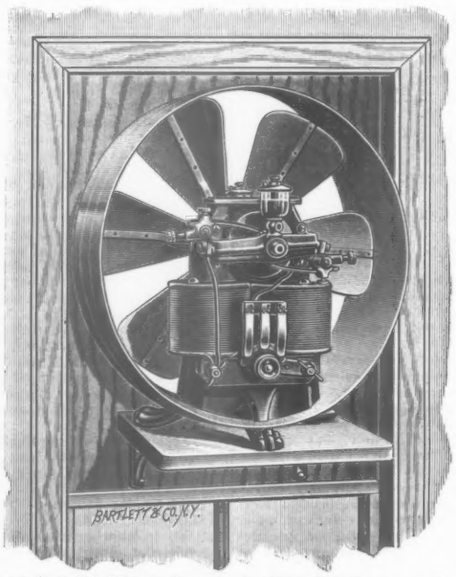


FIG. 3.—THE "C. & C." MOTOR COMPANY'S NEW ONE-QUARTER HORSE POWER EXHAUST FAN.—(See description on page 8).

Alexander Thorndike Rice.

By the sudden and entirely unexpected death of Mr. Alexander Thorndike Rice, at the Fifth Avenue Hotel, in this city, on Thursday, there was removed from the ranks of American editors one of the most prominent members. Mr. Rice was born in Boston in 1853, and while a comparatively young man had attained his position of prominence mainly through his own persistent efforts.

Left an orphan at an early age, and with a handsome fortune, he chose a literary life and a life of tireless activity. He was educated abroad largely and returned to this country soon after his graduation from Christ College, Oxford. He immediately began writing anonymously for the leading periodicals and magazines. His ambition was not satisfied, however, and in 1877 he bought the *North American Review*, which, under his management, almost at once sprung into popularity. Later he added to his journalistic enterprises by purchasing *Le Matin*, a Parisian newspaper. Mr. Rice was remarkable for his energy and industry. In addition to editing the *Review*, every department of which he carefully superintended, he looked after a large ranch in the West, an inherited estate in Maryland, discharged his duties as trustee of other large estates and took an active part in politics. On March 27 last Mr. Rice was appointed by President Harrison United States Minister to Russia, and was to have sailed on Saturday last.

A Far-Sight Machine.

Mr. Edison is reported, in a conversation with a reporter who solicited his ideas on the subject of the projected World's Fair in New York City, as saying that he would take an acre of space in such a fair and completely cover it with his inventions, of which he has no less than 70 now under way. "One of the most peculiar and now promising good results," said Mr. Edison, "is what I may call a far-sight machine." By means of this extraordinary invention he hopes to be able to increase the range of vision by hundreds of miles, so that, for instance, "a man in New York could see the features of his friend in Boston with as much ease as he could see a performance on the stage. That," he added, "would be an invention worthy a prominent place in the World's Fair, and I hope to have it perfected long before 1892."

Relation Between Texture and Conductivity of Iron Wires.

Experiments were undertaken on 21 different samples of wire in order to ascertain, if possible, the reason for the acknowledged superiority of Swedish iron wire. The wires were subjected to tests of the breaking strain; they were analyzed in order to ascertain the exact amount of impurities in the iron, and they were carefully examined under the microscope for any differences of texture which the iron might present. The results are tabulated, the wires being arranged in order of their conductivity.

The tables show that, generally speaking, the strongest wires are the worst conductors, and the less the elasticity the less the conductivity. The effect of the presence of impurities in the iron cannot be so clearly seen. The percentage of carbon in the wire necessarily affects the breaking strain and the elasticity, and hence indirectly the conductivity, but no simple relation was found. Generally speaking, an increase in the percentage of phosphorus means a decrease of conductivity; the same result was observed in the case of manganese. Indeed, if the percentages of phosphorus and manganese are added together the conductivity is seen to be inversely proportional to the amount of these impurities in the iron.

The microscopic examination of the wires led to the following conclusions: The finer the grain the higher the conductivity; in wires of very even grain the conductivity increases with the evenness; small flaws, such as blisters, cinder-holes, faults in welding, when evenly distributed, have no particular effect on the conductivity; large blisters and welding flaws have only a small effect in diminishing the conductivity if they occur separately; cinder-cracks and welding flaws when they are numerous and run in the direction of the length of the wire diminish the conductivity considerably; cross flaws and cracks diminish the conductivity most. Classified according to the microscopical observations the 21 wires fall into four groups—1st, the fine-grained even wires; 2d, the coarse-grained wires with increasing amount of flaws and cracks; 3d, the coarse and uneven-grained wires; 4th, the very coarse-grained and uneven wires.

A wire of the first-class (9.50 conductivity and above), should not have a higher breaking strain than 36 kilogrammes per square millimeter (23 tons per square inch), nor an extension of less than 12 per cent.; the total of all impurities should not exceed 150 thousandths, or the total of manganese and phosphorus 125 thousandths; the texture must be even and fine-grained, without blisters, flaws or cracks. A wire of the second class (7.75 to 9.50 conductivity), should not have a higher breaking strain than 45.1 kilogrammes per square millimeter (29 tons per square inch), nor an extension of less than 17.2 per cent.; the total of all impurities should not exceed 450 thousandths, nor the total of manganese and phosphorus 400 thousandths; the texture may be coarse-grained, but it must be even. A wire falls into the third class when, although its breaking strain and extension would rank it in the second class, its texture is uneven or full of flaws. A breaking strain of more than 50 kilogrammes per square millimeter (32 tons per square inch), and an extension of less than 8 per cent., together with a very coarse and uneven grain, bring a wire into the fourth class and render it unsuitable for use as a conductor or line wire.

In all probability the material for a wire of first-class conductivity can be obtained by smelting in a crucible or in a reverberatory furnace; the products of the Bessemer converter can never be suitable.—*Elektrotechnische Zeitschrift.*

*** The Boston *Herald* of Tuesday publishes a two column interview with President Whitney of the West End road, in which he expresses his great satisfaction with the electric cars in use in Boston, and showing the hurtful effects which would follow the adoption of the bill now before the Massachusetts Legislature prohibiting overhead wires for electric roads in cities of over 60,000 in population.

Receiving Messages Through the Sense of Touch.

A REMINISCENCE FROM THE EARLY HISTORY OF ELECTRIC TELEGRAPHY.

The interesting account of the deaf and dumb telegrapher on page 7 of the ELECTRICAL REVIEW for May 4, reminds me of a fact with which surely very few telegraph operators of the present day are acquainted, namely, that among the very first devices constructed for the purpose of using electric currents for telegraphic purposes, those operating by the sense of touch once occupied a prominent place.

The idea to use the alternate attraction of an electro-magnet for the purpose of transmitting signals at a distance was conceived by many minds very soon after its invention by Sturgeon in 1828. Barlow, in England, occupied then a prominent position among the electricians of that period, as among other things he had distinguished himself by his labors to correct the influence of ships' iron upon the compass needle, and had produced an electro-motor, beautiful for its simplicity, and which is called after him *the wheel of Barlow*. He was asked to test the simplicity of operating electro-magnets at a distance, and he reported adversely, finding that he did not succeed as soon as the length of the wire transmitting the current was measured by miles. His results were published and accepted, wherefore experimentors turned their attention in other directions. Among them was Professor Vorselman de Heer, of Deventer, Holland, who found also that ordinary battery currents were not available to work electro-magnets through long wires, and finding that the current of a Voltaic pile could be made sensible to the touch over many miles of wire, constructed what is called the physiological telegraph, which I saw in operation at the University of Deventer, Holland, in 1838. The receiver consisted in a key board of eight keys, like a piano, on which the fingers were placed; each key was connected with a wire, so that a cable of eight wires was required. The alphabet was based on the 30 different combinations of two, which may be made between eight fingers, which were numbered, while he called the numbers of every two fingers in which the current was felt. These numbers were recorded by an assistant, until practice made him able to read without such a record.

If this inventor had known that Professor Henri, had in Washington, a little before this, succeeded in charging electro-magnets at a distance, simply by coiling them with long and fine wire in place of the heavy wire then customary, he might, perhaps, have labored in the same direction as Morse did, who, in the same year (1848), made his first application for patent, and a little later for a relay, which was also Henri's invention. Morse, however, invented the alphabet of dots and dashes, which was a most important improvement, because, simple as it is, it enabled telegraphy to be conducted over a single wire.

In the meantime those who had not heard of what was going on in this direction in Washington and New York had faith in the physiological telegraph, which for long distances was supposed to be superior to the needle telegraph, which was gradually developing in England and Germany.

It is scarcely necessary to mention that the physiological telegraph was by no means in high favor among the operators, and very soon was put aside and is now forgotten.

P. H. VAN DER WEYDE, M. D.

Another Phase of the Underground Wire Problem.

Mr. Frank Ridlon, E. E., of Boston, presented the following for the consideration of the committee on street railroads of the Massachusetts legislature at Boston last week:

To the Committee on Street Railroads:

GENTLEMEN—Unbiased legislation should place electric service in a city or town on the basis of public improvement, entitled to special privileges in order to secure the service for users on terms and conditions best calculated to serve the interests of all citizens. Will underground service do this in its present defective, and I may well say, dangerously undeveloped condition? I say this advisedly, and would respectfully refer to the Boston Board of Fire Underwriters as to the increased danger on fire risks which have been caused by underground systems, and would also refer to C. J. H. Woodbury, vice-president of the Manufacturers Mutual Insurance Company as to its danger both as concerns fire risks and personal injury. No underground system has yet worked satisfactorily for 90 consecutive days. The only underground system which will be effective is a subway properly so called, furnishing space, air and adaptation to the every day inspection of the wires, and this is what will be adopted at some future day. In the mean time, the past history of the overhead system will certainly admit of its continuance for the present. Its record is, that with 600 miles of overhead wire in Boston, the insurance companies have not lost one dollar on fires caused by electricity, and statistics show that there are more fatal accidents in the various employments where power is used in the short period of six months in any of our large cities, than all the accidents, whether fatal or otherwise, which have been caused in the whole world from electricity since it was first brought into use. Please note these facts, as they can be fully proven.

The Western Union Has Not Gobbled the Postal Telegraph Company.

The Postal Telegraph Company have found it necessary to send out the following circular:

"As the arrangements recently made between the telegraph companies have been greatly misrepresented by newspaper publications and otherwise, and we find that both our patrons and some of our own employés have become apprehensive and disturbed by rumors of 'consolidation,' it is deemed proper to say officially, to all concerned, that the legitimate and active competition with the Western Union Telegraph Company and the 'pooled' Cable companies, as established by the 'Commercial' and ourselves, is in no way diminished.

"The recent action of the companies amounts simply to this—the Western Union Company has recognized the impracticability of destroying competition, and we have agreed with them upon a schedule of rates, materially reduced in many cases from those heretofore charged by them; that no reductions therefrom shall be made, between competing points, except by mutual consent, and that the pernicious and unfair practice of paying rebates, and offering other irregular inducements in order to control business, shall be absolutely done away with."

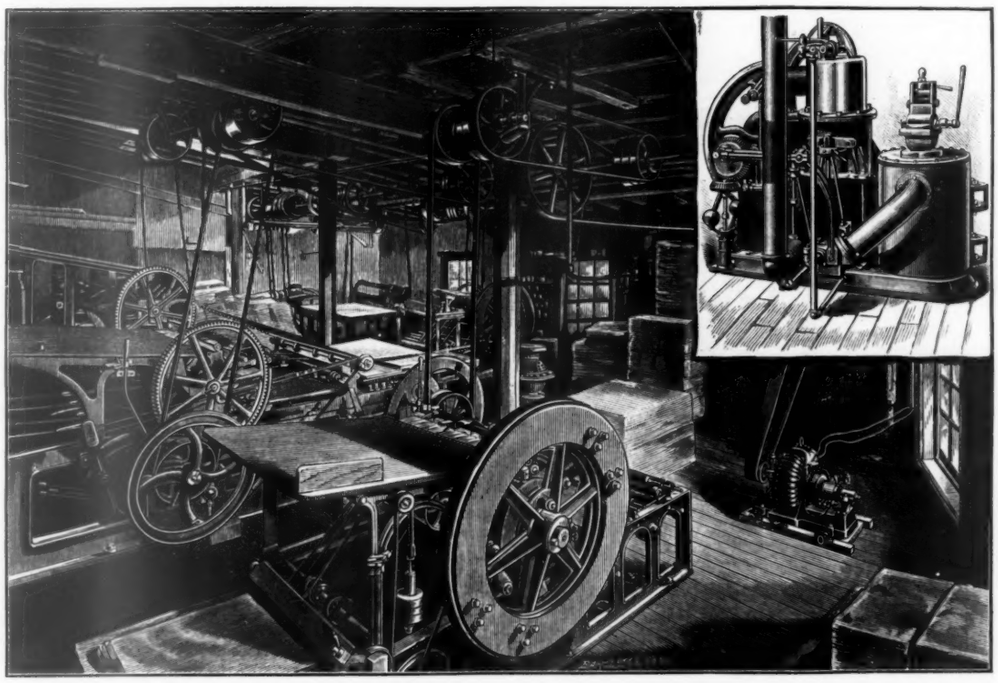


FIG. 1.—A "C & C" 3 H. P. MOTOR FURNISHING POWER FOR A PRINTING OFFICE.—(For description, see page 8.)

A New Method of Testing Batteries at Work.

The new method is based on that of Mance, from which it differs by the introduction into the galvanometer circuit of an electro-motive force which is exactly equal and opposed to the potential difference at the ends of the galvanometer circuit. If the resistance of the galvanometer circuit is made very small, there will be no current through the galvanometer when the bridge circuit is open. The current has therefore to be allowed to increase much less than is the case in Mance's method (12 per cent. instead of 300 per cent.) in order to obtain a deflection of the galvanometer needle with a decrease in the ratio of the two parts of the metre wire by about ½ per cent.

*** The holders of 1,800 of the 2,400 shares of stock of the Watervliet Turnpike and Railroad Company met last week and voted to borrow $350,000 on an issue of bonds to that amount, secured by a mortgage. The money is used to improve the road generally and to introduce an electric motor system. The bonds have been placed in the hands of Brewster, Cobb & Estabrook, of Boston, who will issue a circular giving copious information about the road and its financial condition, and negotiate the sale of the bonds.

TELEGRAPHIC

.... The Railway Telegraphers, of Denver, Col., hold interesting meetings at their rooms in Larimer street on Sunday afternoons.

.... The Western Union Telegraph Company at Branford, Conn., has a messenger boy over 70 years old named Miller, who remains on duty all day and far into the night. He always walks, and is sent often on jaunts of several miles.

.... The lines of the Pacific Postal Telegraph Company, which works in connection with the Mackay cables and Canadian Pacific Railway Company's telegraph, reached Los Angeles, Cal., recently. This is the first competing line that ever reached this city. The Pacific Postal Company now have a continuous double wire form Vancouver, B. C., to Los Angeles, a distance of about 1,600 miles, and are doing a large business.

.... The Conn. Assembly has reported a bill taxing telegraph companies doing business in the State 25 cents for each mile of wire owned, operated or leased within the State (no other tax to be imposed on appliances); real estate to be taxed by towns. Telephone companies shall pay 70 cents for each transmitter in use in its lines in the State and 25 cents for each mile of wire (no other tax on appliances); real estate to be taxed by towns; calendar.

.... It is very desirable to avoid by all means the heating of phosphor-bronze wires, as this leads to a decrease of the breaking strain; and consequently some means of jointing had to be sought for which might replace the method of soldering used for iron wires. Moreover, experience has shown that some local action is set up between the tin solder and the iron wires, which in time leads to a weakening of the joint; such action would of course be still greater with phosphor-bronze wires, owing to the greater affinity of tin and copper.

The best substitute for solder is a copper amalgam prepared as follows: Freshly precipitated copper oxide is heated in a tube in a stream of hydrogen until it is reduced to metallic copper. When thoroughly cooled, this fine copper powder is moistened with dilute sulphuric acid and well mixed with mercury, and is then washed. A simpler plan, though not such a good one, is to obtain the copper powder by reducing copper sulphate by means of metallic zinc.

In making use of this amalgam for jointing wires, it is pressed closely round them and allowed to set. On this account a twisted joint is not very well adapted; a Britannia joint is better, as the amalgam penetrates inside the binding wire. But the best joint is made with a tube connection, the two ends of the wires being turned up at not too sharp an angle and secured with binding wire; the amalgam is then pressed well into the tube, where it sets quite hard.

Standard Daniell Cell.

A small copper disc is covered with a fairly thick linen disc soaked in solution of copper sulphate, and on this is laid a larger disc of parchment paper. Then comes a linen disc as before, but soaked in solution of zinc sulphate, on which is laid first a very thin amalgamated zinc disc, and finally a thick zinc disc on top of all.

The cell is contained in a wooden box in which are three receptacles for the two solutions and distilled water, and others for copper and zinc wires and for copper and zinc forceps for taking hold of the dics. For each measurement new linen discs and a new thin amalgamated zinc plate are used.—*Beiblatter.*

* * The Sprague Electric Railway and Motor Company will build an electric road from Bay Ridge to Coney Island.

* * A petition is being circulated in Cincinnati praying that electric street railways be still further extended in the 25th ward of that city.

* * One estimate has already been received for the building of the Alameda electric railway in Denver, Col. The company is satisfied that sufficient funds will be secured to push the work. Surveyors are now fixing the grade.

* * The Advance Illuminating Company, of Newark, has petitioned the city council for permission to lay a subway in the streets of that city for electric service, either lighting or power, for public or private purposes. Indurated fibre pipe is the material it is proposed to use for the conduit.

* * The Decatur (Ill.) Electric Company has commenced laying two miles of street railway track, and will put in a plant to cost $100,000. Detroit and Louisville capitalists, it is said, are furnishing the money. The Citizens' Company, operated by Decatur capital, will run its street cars by electricity by July 4th.

* * The proposed improvements to the Watervliet railroad will consist of an electric plant, 12 new cars, 16 motor trucks and new rails. Eight of the motor trucks will each be capable of hauling another car. Making the terminus in Troy instead of West Troy is expected to greatly benefit the road.

* * The Fort Worth Loan and Construction Company, of Fort Worth, has bought the Gainesville (Texas) street railway, and will extend it to 10 miles in length and change to electric power. This company has also purchased the San Antonio street car line, and will operate it by electricity.

* * Denver's new suburb of Edgewater will have an electric motor line. The line will run from a point on Gallup avenue, where it will connect with the Tramway Company's road, westerly, north of Sloan's Lake to south line of the north tier of 40-acre tracts. The road will form a great loop completely encircling the lake.

* * The annual meeting of the Beacon Electric Company, of Boston, was held at the Rockingham, in Portsmouth, N. H., last week, and a new board of directors elected for the ensuing year as follows: John A. Enos, H. D. Tewksbury, F. B. Copeland, William Stockford and Charles S. Bates. The company is organized under the laws of New Hampshire.

* * The Kearney brick works of Kearney, Nebraska, are now using an electric motor to furnish power for the manufacture of brick. This company have capacity of 85,000 bricks a day, of which 35,000 are dry pressed brick. It rather surprises eastern people who have been accustomed to the methods used in their section of the country to visit brick works where the power is secured by electricity. The magnificent water power of Kearney is used by the electric company, so they can furnish 500 horse-power per day at a rate per horse-power per annum about half the cost of steam power in the East. The Kearney paper mill uses 100 horse power and one of their motors is of 65 horse-power; it is one of the largest motors in practical use in the world. Many other manufacturing establishments in Kearney are now using or arranging to use electric motors to furnish them power.

"C. & C." Installations and Apparatus.

Electricity as a motive power continues to replace other forms of energy, new examples coming to light daily. One of the most recent which has come to our notice is an installation by the "C. & C." Company, illustrated in the accompanying cut (Fig. 1). A three horse-power 110 volt motor was put in here, replacing a seven horse-power hot air engine, which is shown in the upper right corner. The work of running 11 printing presses, three of them of the large cylinder type, is now successfully accomplished by this little electrical engine, and it not only replaces the hot air machine, but does more, the printer stating that he now takes 3,000 impressions a day over what was formerly his maximum amount. Another installation by the "C. & C." Company is shown in Fig. 2. This is in the manufacturing department of the Moloney Suit Company, on Broadway. A two horse-power arc motor on the Brush circuit is there running 25 sewing machines, and has given entire satisfaction from the first. Fig. 3 shows a one-fourth horse-power incandescent motor fan outfit. It is the ordinary type of motor, with an 18 inch six-blade fan, and, as shown in the cut, is set up to be used as an exhaust. Running at a speed of 1,000 revolutions a minute, gives it the advantage over more closely built but slow running fans. Two of these outfits have been successfully employed to ventilate a hall 100 feet square, being placed opposite each other and both used as exhausts. A room considerably longer and one-half as wide is easily ventilated by placing a fan at either end, one running as an exhaust and the other forcing air in. The form of motor here shown is of nearly the same proportions as the ⅙ horse-power fan outfit which has proved so popular in the past and of which several hundred have been sold this year. Fig. 4 shows the "C & C" type of arc motor, one horse-power capacity, wound for 9½ amperes. The motor has been in successful operation for some time, but has been lately improved, and the cut is now shown for the first time to the electrical public.

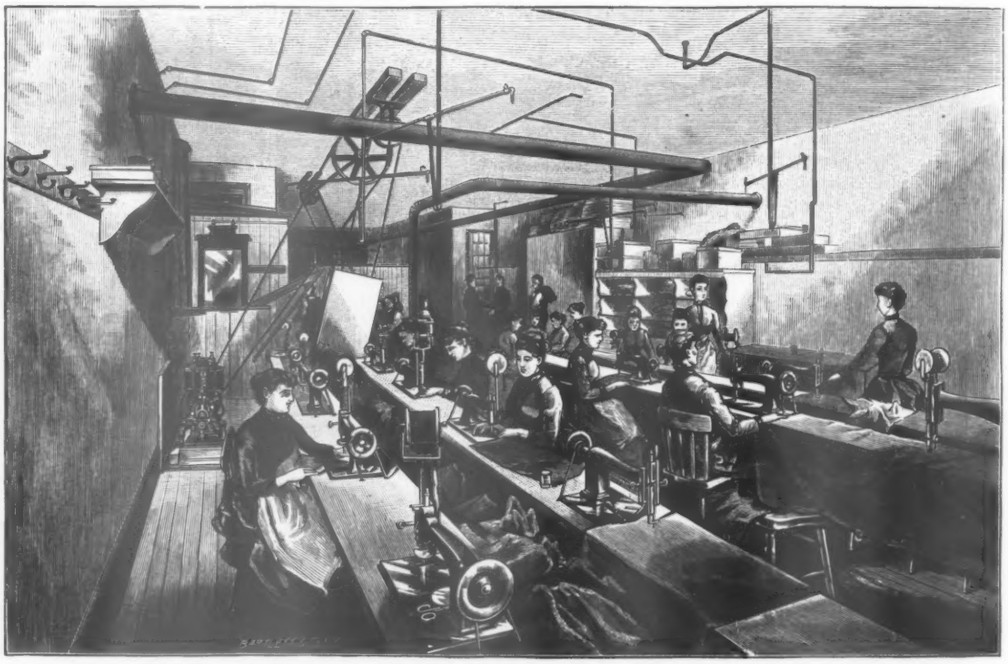


Fig. 2.—A Two Horse Power (Arc Circuit) "C. & C." Motor Operating 25 Sewing Machines.

* * A fleet of small twin screw boats, propelled by electricity, will run on the Thames river, England, this summer. They will transport passengers from place to place over short distances. The electricity is to be generated from accumulators carried on the boats, and recharged when necessary at any of the river stations. The boats are 65 feet long, 22 inch draught, and carry 80 passengers.

* * Mr. Charles B. Hurley, son of Wm. H. Hurley, of Philadelphia, has been appointed general manager of the Tacoma (Washington) Water Gas and Electric Light Company.

* * The importation of American plants continues to increase in rapidity and importance. It may have been noticed that the steamships "Erin," "Holland," "Umbria," etc., have brought during the last month nearly a hundred cases of electrical goods, consisting of motors, secondary batteries, to the orders of Messrs. Shippey Bros., and various installations throughout the country, while Westinghouse, Thomson-Houston, Woodward Electrical Company, and others are shipping largely. It seems that the Americans mean to do as large a business in England in electrical apparatus as they do in the States.—*Electrical Engineer, London.*

* * In our description last week of the R. T. White rail and chair, the types made "tamped" read "two feet." The paragraph referring to the advantages of Mr. White's pattern of chair, which advantages railroad men would fail to see were it necessary to place the chair "two feet" in the ground, should have read, "The chairs are set on and secured to wooden sleepers by lag screws, as shown, but the wooden sleepers may be dispensed with by enlarging the base of the chairs sufficiently to give them a solid bearing when tamped in the ground, or they may be set in concrete."

* * A reunion of the class of '87 Massachusetts Institute of Technology, which is to be held at Young's Hotel, Boston, on Saturday evening, May 25, will bring together several young men who have already reached places of trust and responsibility in the electric field. Among these are Mr. George W. Davenport, manager of the Thomson-Houston International Electric Company; Mr. Hollen C. Spaulding, manager of the Thomson-Houston stationary motor department; Mr. G. F. Curtiss and Mr. W. S. Hadaway, both occupying important positions in the manufacturing department of the Thomson-Houston Company at Lynn, Mass.; Mr. F. C. Todd and C. K. Stearns, of the Thomson-Houston street railway department; Mr. H. D. Sears, purchasing agent for the Thomson Electric Welding Company; Mr. O. S. Hussey, expert on the Edison ore separator; Gilbert Morrison, engineer of a Philadelphia light and power company; and Mr. S. C. Hathaway, Jr., with the Sprague Electric Railway and Motor Company. Many others who have attained places of prominence in the electrical field in different parts of the country, would be there were it not for the barriers of distance.

Use of Overhead Wires Continued in Boston.

Mayor Hart, of Boston, Mass., signed the aldermanic order last week allowing the West End Street Railway Company to use the overhead electric system with single trolley in any Boston street they may desire. This action is in accordance with public expectation, as it was generally understood that approval would be given as soon as the West End should send in an agreement to indemnify the city from any damage that might arise from the wires.

This agreement, with others of a kindred nature, was given to the mayor, and was by him submitted to the corporation counsel, who returned it with his approval. The indemnity agreement is as follows:

Know all men by these presents, that the West End Street Railway Company, a corporation duly established by the laws of the Commonwealth of Massachusetts, is holden and stands firmly bound and obligated with the city of Boston, in the said Commonwealth, in the full and just sum of $50,000, to be paid unto the said city of Boston or its assigns, to which payment, well and truly to be made, said West End Street Railway Company binds itself in the sum above named firmly by these presents.

The agreement also says that if the different electric systems of the city are not impaired by the single trolley system, then this obligation is to be void. In that case the company promises to place underground its power or feed wire, with a view to preventing or avoiding many liabilities to injury and the impairment of the efficiency of the city wires. Guard wires over the trolley wire in certain places are also promised with the object in view. A "metallic circuit" system is also promised if the fire department requires it, as well as such other precautions as are needed from time to time for the same purpose of protection from injury and of the city's wires. The agreement is signed by President Whitney, under seal.

This agreement is made as to the neces sary cutting of wires:

In consideration of the permission of the board of aldermen of the city of Boston, dated May 1, 1889, and approved by the mayor this day, to the West End Street Railway Company, to establish, construct, maintain and use the overhead single trolley electric system of motive power in the operation of its cars in the streets of the city of Boston, as set forth in said order, and

Whereas, in the event of a fire it may be deemed necessary by the officers of the fire department of said city that, in order to better extinguish or prevent the spread of such fire, it may be necessary to cut the wire or wires of said West End Street Railway Company authorized by said order:

Now, therefore, it is hereby understood and agreed that in such case the officers or men of said fire department may cut said wire or wires without any liability therefor on their part or on the part or said city to said West End Street Railway Company, and that the wire or wires so cut shall be repaired and restored by the said West End Street Railway Company at its own expense and without expense or cost to said city.

The Schuyler Plant at Marion, Ohio.

The record of the Marion Electric Light and Power Company is a noteworthy one in several particulars. The plant has been in operation but six months and operates already some 18 miles of lines. An increase has just been contracted for, the order being for an 80 horse-power Ball engine, a 100 horse-power boiler, and a 35-light Schuyler dynamo. This increase is made necessary by the demand for more lights, showing the satisfaction they are giving to outside parties and speaking well for the management of the superintendent, Mr. George E. Turner, who in turn expresses his entire satisfaction with the working of the plant. Crude oil is being used for fuel with the greatest success, and no difficulty is experienced in getting insurance.

Alternate-Current Apparatus to Replace Induction Coils for Measuring Purposes.

The author makes use of a Poggendorff inverser, in connection with a telephone, in which the noise of the sliding spring over contacts of metal points and mercury is avoided. The wooden roller is provided with two pointed discs separated from each other by means of paraffined paper, which dip into mercury contained in ebonite cups. The level of the mercury in the cups is regulated by screwing iron screws in or out of them; when not in use these screws are withdrawn so far as to allow the mercury to fall into hollows, where it is protected from dust. The duration of the current can be regulated to $\frac{1}{240}$ to $\frac{1}{560}$ of a second.—*Beiblatter.*

New Contracts of the National Electric Traction Company.

The National Electric Traction Company, of Detroit, now controlling the Fisher system, and of which Mr. Frank B. Rae is the electrical engineer, have lately closed contracts for and are equipping roads at Adrian, Mich., which is to have three cars with motors of 15 horse-power each, three miles of tracks for the Fort Worth City Railway Company, of Fort Worth, Texas, which is to have 10 cars, 10 miles of track, two 50,000 Watt dynamos and proportionate engine capacity, for the Fort Worth Land and Street Railway Company, of Fort Worth, Texas, 15 cars 15 miles of track and three 50,000 Watt dynamos, and at Decatur, Ill., for five cars, two miles of track. This plant is to be in combination with an incandescent electric light plant.

The company are also newly equipping the East Detroit & Grosse Point road with the Rae system, and expect to have the cars run by that system within two weeks. The officers of the National Electric Traction Company are Hugh McMillan, president; W. A. Jackson, vice-president; Frank C. Snow, secretary and treasurer.

— These are nights when, under the electric light contract, the moon is on duty. The moon was reported out last night.

— The city of London is about to be electrically lighted from Fleet street to Aldgate and from its northern boundary to the river. The arrangement which the commissioners of sewers made is the largest scheme of electric lighting which has yet been ventured upon in Europe, and with good management there seems to be no reason why it should not be a complete success. The contract is to be for 21 years, and, bearing in mind the improvements which will probably be made in electrical illumination during that long period, the commissioners have not lost sight of the public interests. They have stipulated that when the profits from the contract exceed 10 per cent. one-half of the surplus is to be applied to the reduction of the charges. Also the commissioners may, if they see fit, purchase the undertaking at the end of the contract. That is an arrangement with which the citizens ought to be well satisfied. It gives the new light a fair chance and protects the ratepayers from the creation of a monopoly.—*St. James Budget.*

— The Joint Committee on Cities and Mercantile Affairs, of the Massachusetts Legislature, have voted it inexpedient to require that electric wires in cities and towns shall be placed underground. They agreed upon a bill making all electric companies using electric wires subject to the same regulations which govern telegraph and telephone companies, and giving authority to towns and cities to remove all unused wires and poles at the expense of the owners.

— There are excellent prospects of electric lights for Exeter, N. H., within a short time. Agents of the Thomson-Houston system have been in the town the past few days looking over the field, and have secured the right of water-power at Pickpucker, a part of the town about three miles from the center, which it is said will furnish 80 horse-power about 10 months in the year. Parties will begin this week to make a survey of the town for the purpose of lighting by electricity.

— The Weymouth Light and Power Company has been organized with a paid up capital of $50,000, and the work on construction has already begun. The system embraces the towns of Weymouth and Hingham, and contracts have already been made with the two municipalities for lighting the streets. The Wright Electrical Engineering Company will erect poles and string wires.

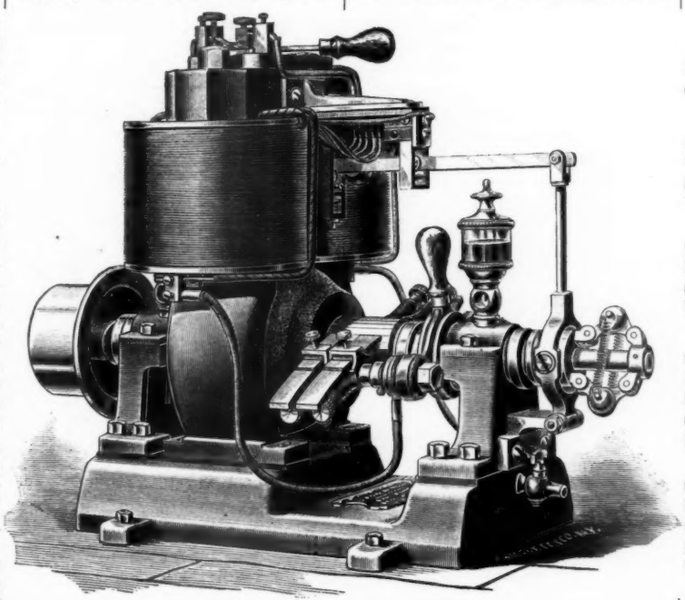


FIG. 4.—"C & C" ONE H. P. ARC MOTOR.

The work of construction will be completed by July 1st, 1889, and the Thomson-Houston system will be used.

— The incorporation committee of the Connecticut legislature has favorably reported on amending the charter of the Hartford Light and Power Company, so as to permit the company to manufacture fuel gas. It is understood that the old pipes of the steam heating company will be used so far as practicable for distributing the gas through the city. The bill was opposed by the Hartford City Gas Light Company, and the favorable report was signed by only five members of the committee, four members signing a minority report adverse to the light and power company's proposition.

— M. Hopkins & Company, of Utica, N. Y., have an arc electric light before their store, 174 Genesee street. Between Nos. 172 and 174 is an iron conductor pipe. One night the light was burning and a young man happened to touch the iron pipe. He fell over and made some ejaculatory remarks. He didn't know what had happened, but was not severely hurt. Another man, who didn't see how it could have happened, also touched the pipe and received the desired information by telegraph. Thereupon Officer Landers stationed himself in front of the conductor pipe, and saw to it that no more scientific experiments were attempted, and the Detective Cleveland notified the Equitable Gas and Electric Company to shut off the light. It was done.

— The directors of the Biddeford and Saco Electric Light and Power Company met in Biddeford last week and elected the following officers: President, George P. Wescott, Portland; clerk and treasurer, E. C. Hersey, Portland, Maine.

— The Putnam (Conn.) Gas Light Company and the Putnam Electric Light Company were consolidated by the purchase of the plant and good will of the Electric Light Company by the Gas Light Company. At a meeting of the new company F. L. Perry was chosen president and W. Bowen secretary and treasurer.

— Chief Engineer Johnson, of the Hartford Electric Light Company, performed a surgical operation Monday. The patient was Timothy Hennessey, a machinist, who got a small piece of steel in his right forearm about a week ago, and has suffered much from it. The big dynamo drew out the offending sliver in less than five minutes.

— The steamship "Manhattan," of the Inter-Ocean Company's fleet, has been provided with an electric light plant. It was operated for the first time on Wednesday night. The "Manhattan" is engaged in the ore trade between Escanaba and Milwaukee and Chicago, and the electric light will facilitate her loading and unloading at night.

— The Minersville Electric Light Company, Minersville, Pa., has adopted the Brush alternating system of incandescent light. The contract for the foundation walls has been given and the erection of the building awarded. The structure will be composed of brick, and it is expected will be ready to receive machinery by the first or middle of July next.

— The directors of the Worcester, Mass., Electric Light Company have decided to build a new station there, and will ask the shareholders to consider the advisability of increasing the capital stock from $125,000 to $200,000 or more. It is proposed to entirely change the steam and electric systems. The alternating incandescent system will be added.

— The electric light company of Westboro, Mass., is going to double its power by the addition of another boiler and engine, as planned for in the beginning. The increase of patrons necessitates the move. The new Catholic church will probably be lighted by the incandescent light, which will require about 200 burners to give proper effect to the elegance of the interior.

—The Reynolds Electric Lighting Company have contract to furnish the electric light plant at Yakoma Park, D. C. The Greenville (S. C.) Street Railroad Company contemplate adopting electricity as a motive power. Franchise has been given a company at Spartanburg, S. C., to build an electrical railroad to Clifton. The Riverside Electric Street Railway Company, of Knoxville, Tenn., has been incorporated, to build electrical railroad five miles long.

ELECTRIC LIGHT NEWS

— The Thomson-Houston Company are to put in an arc and incandescent plant at Burlington, Vt.

— New Britain, Ct., has voted to increase the number of electric arc lamps in the city streets to 76.

— The Providence, R. I., aldermen have authorized a five-year electric light contract. Three hundred arc lights will be used.

— It is rumored that there is a project under foot to combine the Norristown Gas Company and the Norristown Electric Light Company.

— Collingwood, near Toronto, Canada, is expending nearly $100,000 in water works, and will next turn its attention to an electric lighting plant.

— The plant of the Fall River, Mass., Electric Light Company is being removed from the School street station to the new station just completed.

— Mr. Fred. S. Palmer, superintendent of the electric light works at Portsmouth, N. H., has tendered his resignation, to take effect as soon as his successor is appointed.

— Leicester, Mass., is to be lighted with arc lamps on the Worcester circuit. Mr. Charles C. Rice, a veteran lineman and telegrapher, has charge of the construction work.

— The Elmira, N. Y., city council have finally decided to contract for the city lighting for four years with the Elmira Gas and Illuminating Company. Thirty five lights will be used at first.

— John Waterman, who has been putting in a plant for lighting Whitman, Mass., by electricity, is now with the Thomson-Houston International Company, and has gone to Cuba on business for his new employers.

— Under the heading "Give Us Electric Lights," the Omaha *Republican* prints a leading editorial calling for more general electric illumination in the city, and complaining of the high-priced but poor gas furnished there.

— The Evansville Gas and Electric Light Company, of Evansville, Ind., have found it necessary to order some additional Brush arc lamps to meet the the demand for lighting in their city.

— A representative of the Brush Electric Company has just returned to Cleveland bringing with him an order for a 600 light incandescent plant to be installed in the works of the Louisville, Ky., woolen mills.

— The patrons of the Boston Museum will be pleased to learn that electric lights will soon supersede gas in that popular theatre. The installation will be in place when "Little Lord Fauntleroy" is revived Monday evening.

— The Philadelphia representative of the Brush Electric Company, Mr. Edward W. Tisdall, has secured another order for a 65 light Brush arc dynamo with dial and lamps. This outfit will be used for central station lighting.

— The aldermen of Gardiner, Me., are considering a committee's report favoring a municipal electric light plant. By the plan it is proposed to establish an arc light system capable of supplying 42 lamps of 1,200 candle-power.

— James Shannon, engineer of the American Electric Light Company, of Carthage, N. Y., was seriously if not fatally injured recently by being caught in the machinery and whipped around the shaft before it could be stopped.

The Topeka Rapid Transit Railway.

THE LONGEST ELECTRIC RAILWAY IN THE WORLD.

The electric railway at Topeka is the longest line which has yet been built using one system and receiving its current from one central station. The roads which have heretofore been built by the Thomson-Houston Company in the West have been constructed in the best possible manner, and are successful in every particular, but the road in question is by far the longest, and no pains have been spared to make it a model road in every respect. The construction work was begun about January 1st and finished about the first of April. When it is called to mind that this road is 14 miles in length and has a total length of track of 20 miles, and that the utmost care was exercised in its construction, even to the smallest details, it will be seen that good time was made.

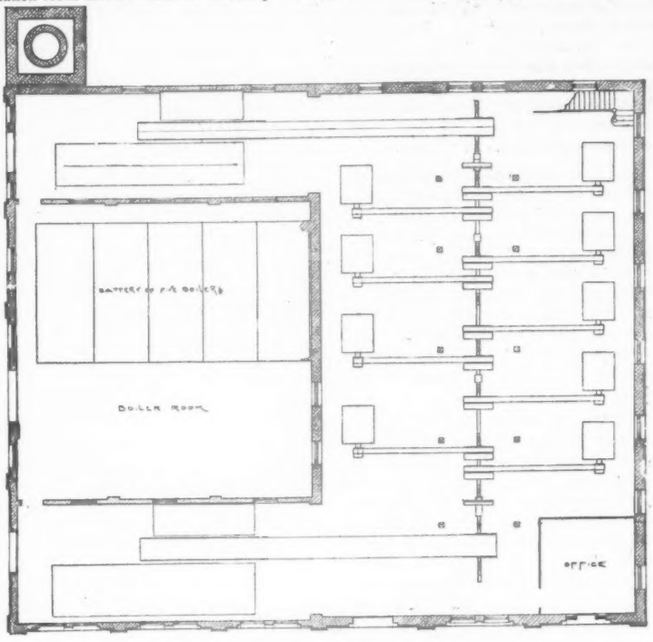
The trial trip was announced for April 3d, and was most successful in every way. The directors of the road and about 100 invited guests made the trip, and at its close expressed themselves in the highest possible terms of the action of the motor cars, the ease with which they could be operated, and the vast improvement which they were over horses and steam motors.

The power station, a very handsome brick building, is illustrated by the accompanying cuts. It is located at the corner of Second and Jefferson streets. It has a front of 100 feet and a depth of 85 feet. One-half of the building is two stories high. At the rear of it is a massive chimney 125 feet high.

The foundations of the dynamos and engines are of solid masonry resting on bed rock, thus securing the utmost stability and firmness.

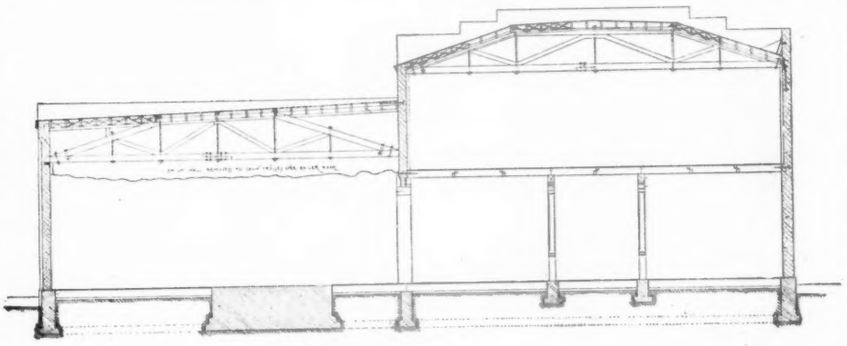
The engines are two in number and are of the Corliss type. They were built by E. P. Allis & Company, of Milwaukee, subject to a special order by L. H. McIntire, the mechanical engineer, who has designed and superintended the construction of the entire plant. The smaller engine is capable of developing 300 horse-power, and has a fly wheel of 20 feet in diameter, weighing 26,000 pounds. The larger engine is of 600 horse-power, and has a 20 foot fly wheel weighing 20 tons. The smaller engine, as will be seen on reference to the cut, is situated at one end of the building, the larger one directly opposite, and both are belted to the main shaft which runs the entire length of the building. Each engine rests on a foundation consisting of a concrete base, upon which are placed large blocks of stone laid in cement to a thickness of about 10 feet. The foundations are entirely independent, so that when the engines are running there is no appreciable jar communicated to the building. The engines are run at 80 revolutions per minute.

The battery of five boilers which supplies the steam for these engines is located between them in a brick enclosure, which entirely isolates it from the dynamo and engine rooms. These boilers are built of the best quality of steel; are six feet in diameter and are each 16 feet long. They are arranged so they can be run separately or in series. The feed-water for these boilers is taken from driven wells 65 feet deep. The water is first pumped into an exhaust heater, and the temperature is raised to 212 degrees Fahrenheit. A peculiarity in this exhaust heater is that the water enters at the top and is received by a crescent shaped pan. From this pan the water runs over the edges, following the bottom until it reaches the center of the pan, when it drops into a similar shaped pan, and so on into another pan until it passes into 16 different pans. By this arrangement the exhaust steam strikes the water as it drops from pan to pan 16 different times, and removes all the impurities that can be taken out with the above mentioned temperature. This water is then delivered by a special pump fitted for handling hot water, into a superheater which is placed above the boilers. This heater is 26 feet long and contains 24 pans like those used in the exhaust heater. Live steam from the boiler is kept at full pressure upon this superheater, which carries the temperature up to 320 degrees. The high temperature to which the feed water is subjected causes the lime, iron, magnesia and other impurities to collect on the bottom of these pans.



PLAN OF FIRST FLOOR

THOMSON-HOUSTON ELECTRIC CO. POWER STATION FOR RAPID TRANSIT RAILWAY CO. TOPEKA, KS. L.H. MCINTIRE, M.E.


TRANSVERSE SECTION.

THOMSON-HOUSTON ELECTRIC CO. POWER STATION FOR RAPID TRANSIT RAILWAY CO. TOPEKA, KS. L.H. MCINTIRE, M.E.

The floor of the boiler room is paved with hard brick. A track for a coal car runs in front of the furnace doors, enabling the fireman to transport coal from without the building to the furnace.

The electrical apparatus consists of five 80 horse-power Thomson-Houston generators for supplying the necessary current. These generators are shunt series wound and connected in multiple. There is also used a large switchboard fitted with the necessary current indicators, switches, etc.

In building the line the overhead method of construction has been employed, the rails serving for the return current. The cars, 12 in number, are each equipped with two 10 horse-power motors.

THOMSON-HOUSTON ELECTRIC CO. POWER STATION FOR RAPID TRANSIT RAILWAY CO. TOPEKA, KS. L.H. MCINTIRE, M.E.

ELEVATION OF SECOND ST.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 14, 1889.

402,915 Portable galvanic battery; Albert Friedländer, Berlin, Germany.

402,928 Telephone system: Fred. A. Holcomb, Grand Rapids, Mich.

402,929 Telephone system; Fred. A. Holcomb, Grand Rapids, Mich.

402,960 Electric bell; Richard R. Moffat, New York, N. Y., assignor by direct and mesne assignments to the Moffat Electric Construction Company, of New York.

402,986 Electric system of communication: Ebenezer B. Shafer, New York, N. Y.

402,990 Commutator brush controller for electric motors; William L. Silvey, Lima, Ohio.

403,009 Slotted conduit for electric conductors; Charles J. Van Depoele, Chicago, Ill.

403,010 Electric connection for railway rails; Chas. J. Van Depoele, Chicago, Ill.

403,011 Electric locomotive; Charles J. Van Depoele, Chicago, Ill.

403,017 Automatic governor for electric motors or dynamo-electric machines; Schuyler S. Wheeler, New York, N. Y.

403,018 Field magnet for dynamos; Schuyler S. Wheeler, New York, N. Y.

403,092 Connector for electric railways; Leon Daft, Plainfield, N. J.

403,100 Electric alarm clock; Thomas H. Grady, Brooklyn, N. Y.

403,104 Electrical signaling apparatus; Adin A. Hatch, Kansas City, Mo., assignor to Benjamin F. Jones, Edward L. Martin and Alfred W. Jones, all of same place.

403,110 Electrically heated vacuum pan; Gail B. Johnson and Milbank Johnson, Elgin, Ill.

403,157 Method of electric welding and shaping of metals; Elihu Thomson, Lynn, Mass.

403,158 Dynamo-electric machine; Henry E. Walter, Schenectady, N. Y.

403,177 Time switch for secondary batteries; Charles E. Buell, New Haven, Conn.

403,180 Electrical float-signaling apparatus; John R. De Mier, La Cruces, New Mexico.

403,192 Electric railway: Rudolph M. Hunter, Philadelphia, Pa.

403,193 Means for the electrical propulsion of boats; Rudolph M. Hunter, Philadelphia, Pa.

403,244 Apparatus for registering the consumption of electric energy; Lucien Brillié, Paris, France.

403,253 Galvanic battery; Charles Colle, Lille, France, assignor to Hector La Housse & Company, same place.

403,256 Device for collecting metallic ores; Henry H. Eames, Baltimore, Md.

403,258 Vibratory telegraphy: Stephen D. Field, Stockbridge, Mass.

403,262 Covering for electric cables; Eben F. Garland, Lynn, assignor of one-half to Solomon H. Holbrook, Salem, Mass.

403,267 Insulated wire: Solomon Heimann, New York, assignor of five-twentieths part to Frank L. Pommer, Stapleton, N. Y.

403,291 Exchange system for telegraph; James H. Robertson, Rutherford, N. J.

403,292 Combined telephony and telegraphy: James H. Robertson, Rutherford, N. J.

403,308 System of electrical distribution; Edward P. Thompson, Elizabeth, N. J.

403,311 Electrical measuring instrument; Edward Weston, Newark, N. J.

403,312 Portable tangent galvanometer; Edward Weston, Newark, N. J.

403,316 Device for holding telephones; Samuel J. Adams, Detroit, Mich., assignor of three-fourths to Monroe Rosenfield, Jacob Brown and Arthur Brown, all of same place.

403,345 Rheostat: John L. Gish, Jackson, Mich.

403,352 Coupling for underground conduits; Wilmot Lake, Washington, D. C.

403,374 Electric riveting apparatus; Elias E. Ries, Baltimore, Md.

403,397 Incandescent lamp; James Stewart, New York, N. Y., assignor of one-half to Edmund C. Stanton, same place.

403,418 Method of protecting the lead pipe of telegraph cables from corrosion; Arthur E. Colgate, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill.

403,439 Electric controlling device for elevator carriages; William E. Nickerson, Cambridge, Mass.

403,440 Electric controlling device for elevators; William E. Nickerson, Cambridge, Mass.

403,441 Electrically controlled elevator: William E. Nickerson, Cambridge, Mass.

403,442 Electric controlling mechanism for elevators.

403,451 Electric battery; John A. Barrett, Brooklyn, N. Y., assignor to the John A. Barrett Battery Company, Baltimore, Md.

403,458 Multiple switchboard testing apparatus; John J. Carty, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill.

403,472 Printing telegraphy; Zeruy P. Hotchkiss, Oak Park, Ill., assignor of one-fourth to Carlos J. Ward, same place.

403,483 Testing apparatus for multiple switchboards; Joseph J. O'Connell, Chicago, Ill., assignor to the Western Electric Company, same place.

403,484 Thermostatic door closer; William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

403,487 Dynamo-electric machine; Frank A. Perret, Brooklyn, N.Y., assignor to the Electron Manufacturing Company, of New York.

403,491 Insulating device for line wires; Thomas J. Smith, Brooklyn, N. Y., assignor to The E. S. Greeley & Company, of Connecticut.

403,492 Electro-medical apparatus; Thomas J. Smith, Brooklyn, N. Y., assignor to The E. S. Greeley & Company, of Connecticut.

REISSUE.

11,002 Electric arc lamp; Clarence B. Noble, Cleveland, Ohio.

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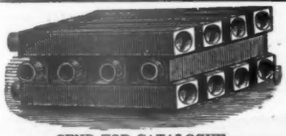
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FIG. 2.

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New York, May 21, 1889.

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We also show you on this page, an illustration of our **Improved Electric Gas Lighter.** We are the sole manufacturers, and owners of patent, and are selling a large number of them. We know that you will be delighted with the Lighter; liberal discount to the trade.

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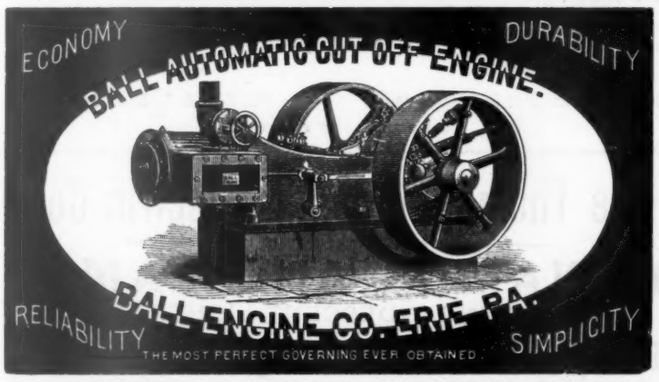

EXTRACT FROM THE REPORT

— OF —

DR. SCHUYLER S. WHEELER,

— ON —

Underground Arc Light Wires in New York.

The line in 125th Street, 2,000 feet in length, is laid in the small ducts of the Johnstone system of conduits. The cable is a ***BISHOP GUTTA PERCHA WHITE CORE,*** and was laid immediately after the order for the work was given. The cable was connected to overhead arc light wires by running it up in a two-inch iron pipe fastened to the outside of an ordinary city electric lamp post. Connections were made with lights in front of stores by carrying the cable from the ducts in iron pipes under the sidewalk and up the front of the stores. This line has been in continuous use for two months, carrying a pressure of 2,500 volts, and it shows an actual rise in insulation with age and use, as will be seen from the following tests:

Jan. 11th, 1,100 Megohms.
Feb. 12th, 1,800 Megohms.
April 12th (including eight arc lamps and branch leads), 2,000 Megohms.

All our White Core India Rubber Insulation is Same Quality as on above cables.

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ETC., ETC., ETC.

SEND FOR CATALOGUE E. AND SUPPLEMENT.

ELECTRICAL TESTING BUREAU,

JOHNS HOPKINS UNIVERSITY.

REPORT of a series of tests of the insulation resistance, capacity and conductivity of a sample covered wire sent by

The India Rubber & Gutta Percha Insulating Co.

The sample submitted for measurement was 2027 ft. in length.
Thickness of insulation was .281 c. m.
Diameter of wire .1632 c. m.

The wire was extremely flexible and was coiled and uncoiled several times before measurements were made.

The insulation consisted of several layers of India rubber, with an external cotton braiding.

The coil was immersed in water on Dec. 16 at 8.30 P. M., and tests were begun the following morning. Both the Direct and Loss of Charge methods were employed. The following are the results:

Capacity in Microfarads per Knot.	Insulation Resistance in Megohms per Knot.	Temperature Centigrade, Degrees.	DATE.
.453	11240	8.5	Dec. 17
.441	9558	13.3	Dec. 18
.456	10080	13.0	Dec. 19
.441	10183	11.0	Dec. 20
.450	9620	10.8	Dec. 21
.450	10000	12.0	Dec. 27

Direct deflection 7200 meghoms per knot at 12° C. on Dec. 27th. Conductivity was obtained by making a number of measurements of the diameter of the wire, and a determination of the resistance of the entire length of the sample at a definite temperature.

The conductivity was 98.5 per cent. that of pure copper as given by Matthiessen.

For the eleven days that the wire was in water the insulation resistance remained practically unchanged, and the slight variation which occurred can be accounted for by the difference in temperature, etc.

The insulation seems to be less affected by changes in temperature than that of other samples which we have tested at various times. Very respectfully,

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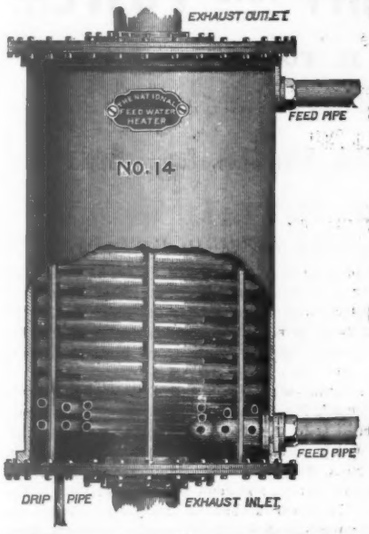

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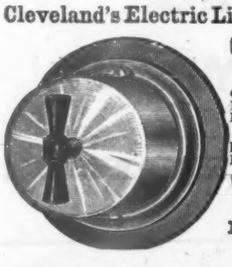

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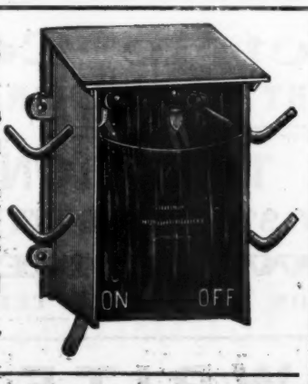

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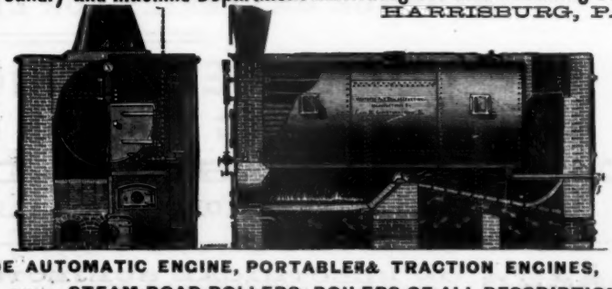

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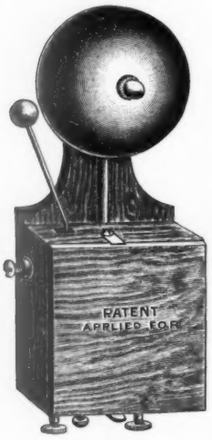

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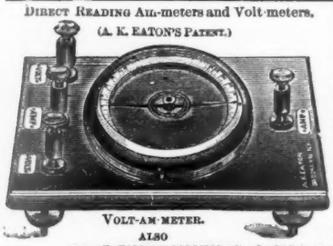

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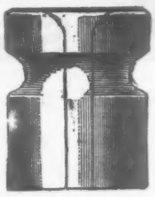

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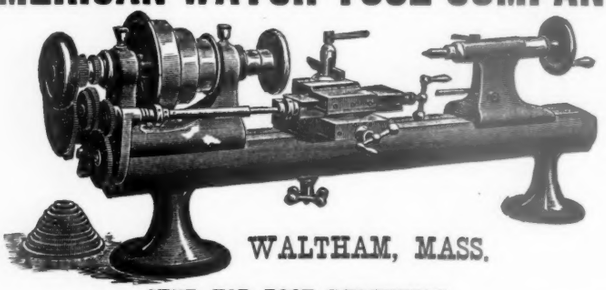

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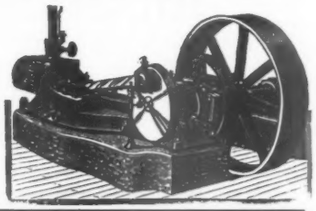

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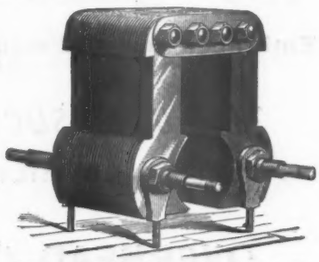

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Akron Electric R. R.....Akron, O.	Hartford & Wethersford R.R .....Hartford, Conn.	Peoples R. R.....St. Joseph, Mo.
Asheville Electric R. R.....Asheville, N. C.	Inclined Plane R. R.....Cincinnati, O.	People's R. R .....Scranton, Pa.
Atlantic City Extension .....Atlantic City, N. J.	Key City Electric R. R..... .....Dubuque, Ia.	Plattsmouth Electric R. R..... Plattsmouth, Neb.
Bay City R. R..... .....Bay City, Mich.	Lafayette Electric R. R.....Lafayette, Ind.	Salt Lake City R. R .....Salt Lake City, Utah.
Bay City Street Ry..... .....Bay City, Mich.	Laredo City R. R.....Laredo, Tex.	Steubenville Electric R. R.....Steubenville, Pa.
Bay Ridge Electric R. R.....Bay Ridge, Md.	Lindell Avenue Street Ry.....St. Louis, Mo.	Stillwater Street R. R.....Stillwater, Minn.
Buffalo Street R. R..... .....Buffalo, N. Y.	Lindell Avenue R. R.....St. Louis, Mo.	Tacoma Ave. Street R. R .....Tacoma, W. T.
Carbondale & Jermyn R. R. .....Carbondale, Pa.	Long Island City & Newtown R.R., Long Island City, N. Y.	Union Electric R. R.... ....Sterling, Ill.
Central R. R.....Davenport, Ia.	Loop Extn., Wilkesbarre & Sub'n R. R...Wilkesbarre, Pa.	Union Passenger R. R.....Richmond, Va.
Chattanooga Electric R. R.....Chattanooga, Tenn.	Main Street Line Extn. U. P. Ry.....St. Joseph, Mo.	Union Passenger R. R. Extn ..... Richmond, Va.
City Passenger R. R.... ....Erie, Pa.	Manchester & Richmond R. R..... ..Manchester, Va.	Union Passenger R. R.....St. Joseph, Mo.
City R. R.....Wilmington, Del.	Marlborough Street R. R.....Marlborough, Mass.	Washington St. & State Asylum R. R..Binghamton, N. Y.
City R. R. Extension.....Wilmington, Del.	Minneapolis Street R. R.....Minneapolis, Minn.	West End R. R.... .....Boston, Mass.
Collamer Line..... ....East Cleveland, O.	Naumkeag Street R. R.....Salem, Mass.	Wichita & Suburban R. R.....Wichita, Kansas.
East Cleveland Street R. R..... ...Cleveland, O.	Northern Div., Wyatt Park Ry.....St. Joseph, Mo	Wilkesbarre & West Side R. R.....Wilkesbarre, Pa.
East Reading R. R..... .....Reading, Pa.	Pacific Ave. Street R. R..... .....Tacoma, W. T.	Wilkesbarre & West Side Ry.....Wilkesbarre, Pa.
East Reading R. R. Ext'n. .....Reading, Pa.	Passenger R. R. .....East Harrisburg, Pa.	Wilkesbarre & Suburban R. R ....Wilkesbarre, Pa.
East Side Street R. R .....Brocton, Mass.	Passenger R. R. Extn.....Harrisburg, Pa.	Williamette Bridge R. R ....Portland, Oregon.
Eau Claire Street R. R..... .....Eau Claire, Wis.	Penna. R. R. System.....Atlantic City, N. J.	Wyatt Park R. R.....St. Joseph, Mo.

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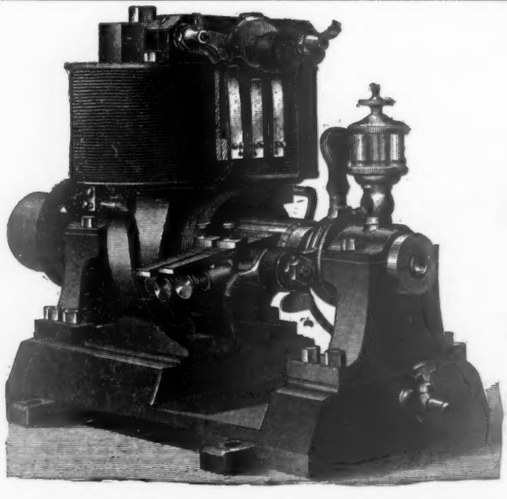

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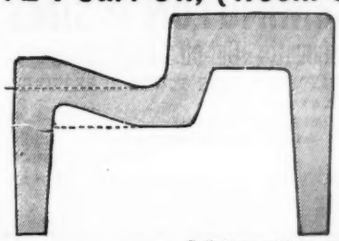

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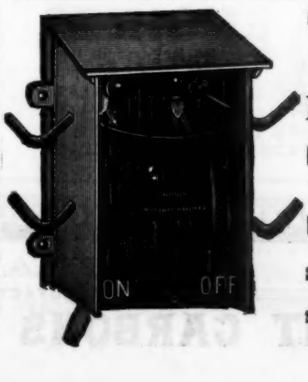

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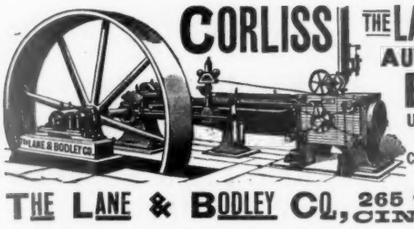

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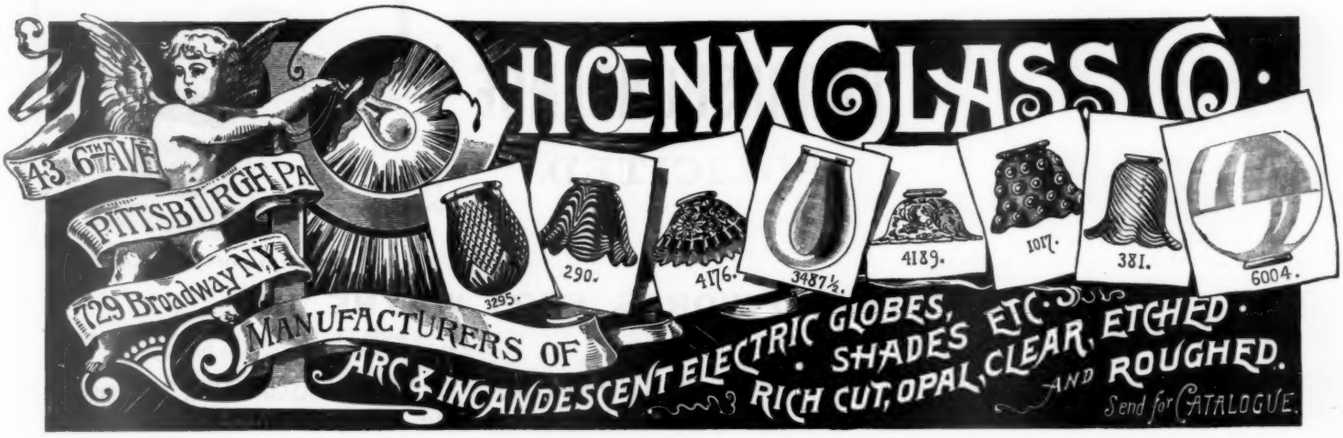

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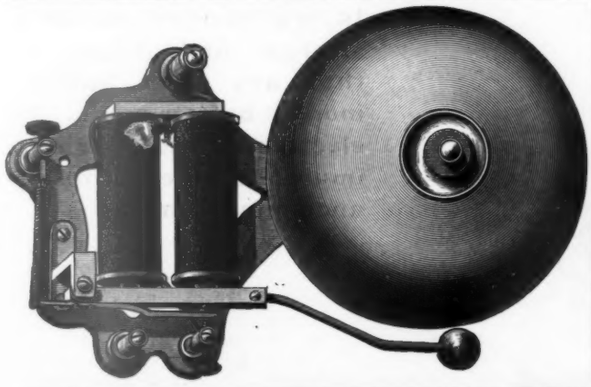

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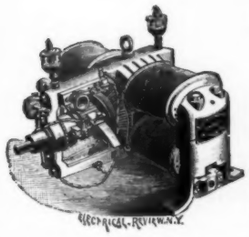

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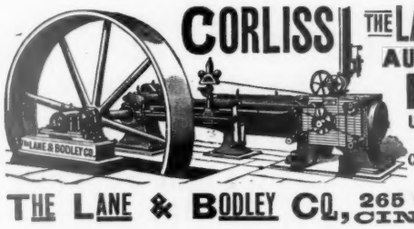

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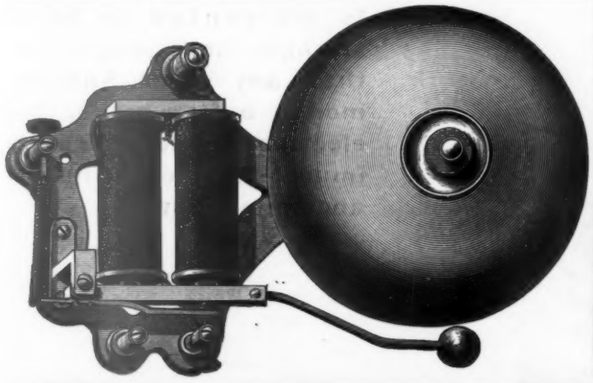

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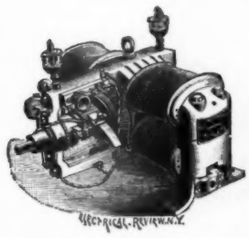

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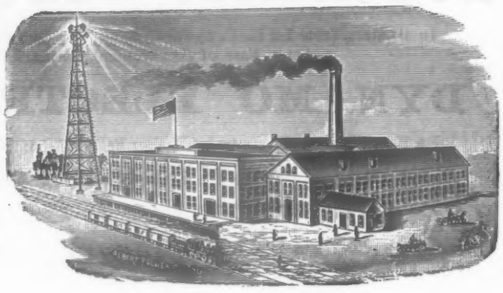

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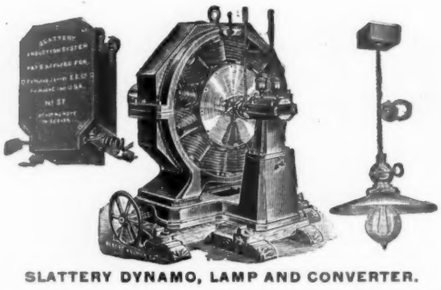

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